Practical Computing

80p July 1983 Volume 6 Issue 7

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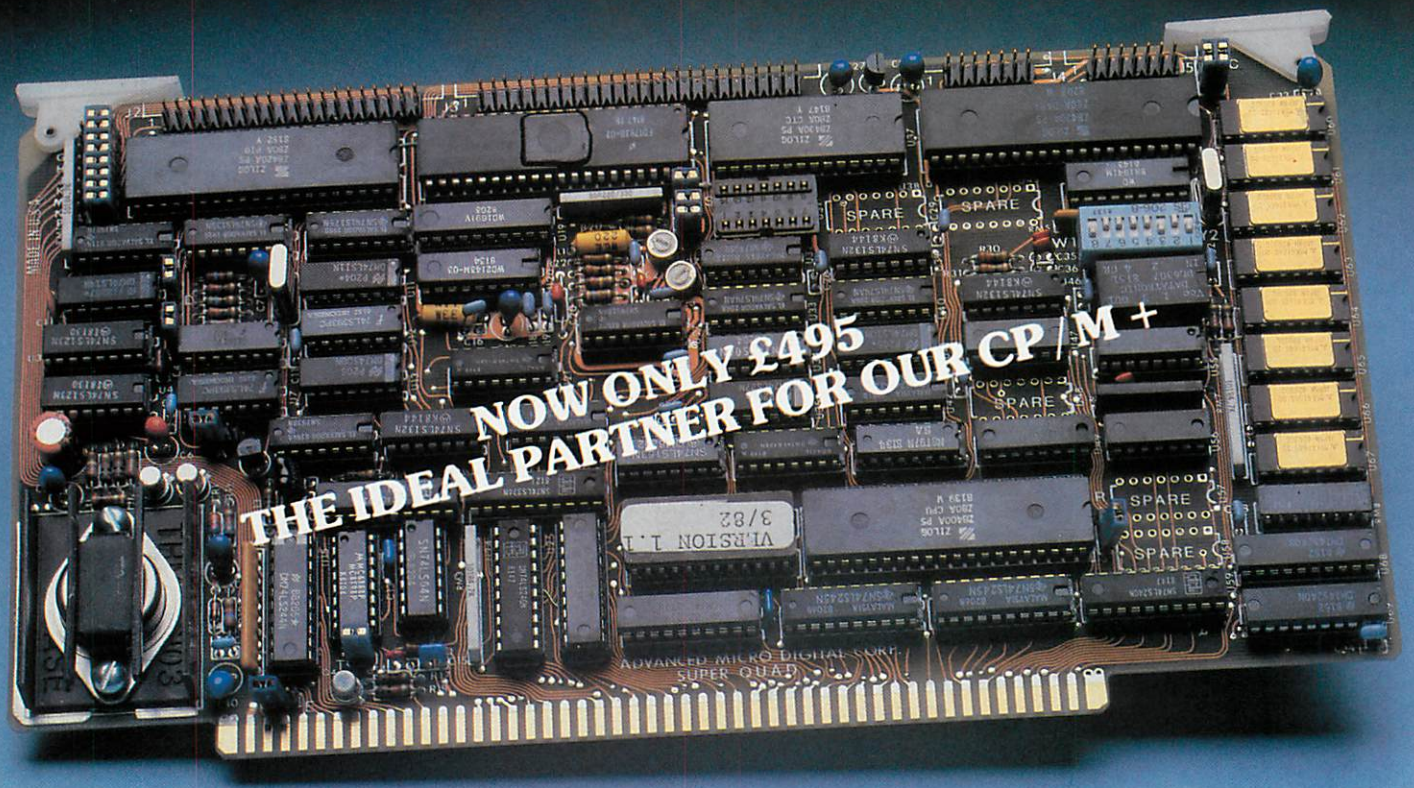
The World's First



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Editor
Jack Schofield
Deputy Editor
Bill Bennett
Assistant Editor
Ian Stobie
Art Editor
Steve Miller
Production Editor
John Liebmann
Sub-editor
Sally Clark
Editorial Secretary
Julie Milligan
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ADVERTISING 01-661 3612
Advertisement Manager
Ian Carter 01-661 3021
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Robert Payne 01-661 8425
David Honeyman 01-661 8626
Advertisement Secretary
Janet Thorpe
Midlands office:
David Harvett 021-356 4838
Northern office:
Geoff Aikin 061-872 8861
PUBLISHING DIRECTOR
Chris Hipwell

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Now we are FIVE

THE FUNCTION of this magazine is sorting microsheep from microgoats and bringing order out of chaos. So we recently published a guide to 16-bit microcomputers. When we started we thought there were about 30; when we went to press there were over 60. Three months later no one knows how many there are. Over 100?

Portables are experiencing a similar boom while eight-bit small business and home computers continue to appear at a terrifying rate. Many more micros of all types are going into production even today. . .

This is the microcomputer boom. After boom comes bust.

No one believes that in two, three or maybe five years time there will be more than 20 or 30 sucessful brands on the market. The obvious inference is that some 330 to 500 micros currently on sale, and untold numbers yet to be launched, will have gone to the wall.

The $64 billion question is which ones will survive?

The answer is not going to be found by looking at either market shares or famous names. A glance at comparable markets for cars, cameras and hi-fis reveals that dominant names can fade in only a few years. Even in the brief history of microcomputing once-prominent micros such as Altair and the Exidy Sorcerer are virtually unknown to the vast majority of today's buyers. Few will appreciate that the burning question for we impecunious neophytes was once "Nascom or Ohio Superboard?"

When it comes to market share bear in mind that only two years ago the Sinclair ZX-80 was, in volume terms, the biggest-selling microcomputer of all time. How many are still in use?

Nor can the choice be made on the grounds of quality. Some truly appalling computers seem to sell in quite large numbers, while far superior ones — such as the aforementioned Exidy Sorcerer — are neglected into extinction. Clearly a large proportion of microcomputer buyers would not recognise a good machine if it crawled across the floor and bit them on the leg. When ignorance reigns as widely as it does now, advertising, marketing and sheer salesmanship count for far more than technical quality. Anyway, even the magazines cannot cope with the flood of new introductions so how can mere mortals cope?

In the good old days of, oh, 1982 it was a good bet to buy a micro for which there was lots of software. This contributed to the continuing success of the Apple, Atari and Tandy micros, and today is an important element in the choice of a Sinclair Spectrum.

This year software writers are on a new tack. Writers who want to get rich quick sensibly now avoid the popular micros. That part of the software market is tough and competitive. There is no room for another Lunar Lander or simple word-processing package. Even the best programs have many rivals. It is far more profitable to write for a new machine that has no software available at all because desperate buyers will just lap it up. Thus the virility of a new computer's software market is no longer an indication of success.

Perhaps the solution is to separate the craze buyer of micros from the serious buyer. Craze buyers are the people who would otherwise be buying CB radios or skateboards or some such, so who cares which micros they buy? We will not need to write about them. Serious buyers are the thoughtful people who have intelligent and intelligible uses — or aspirations for such uses — for micros, and they read *Practical Computing*. When the craze buyers have got bored with their whizz-bang machines they will move on to something else. The machines we support will than be left in the market, occupying a commanding position.

We have already outlived a lot of micros and we expect to outlive a lot more. While it may not be true, at least the idea that sanity will eventually return to the market place is a comforting thought for magazine's fifth birthday.

5 Years ago...

We seem to be hearing all the time about the Pet system from Commodore Systems, but Pet's 'kid sister', the Kim 1 microprocessor, is also beginning to make an impact. One company which distributes it, GR Electronics of Newport in Gwent, has announced a range of new features which turn the basic system, which retails at £161, into a sophisticted and powerful machine.

GR is selling a video board at £150 which allows the Kim 1 to be plugged straight into a domestic television set, for use as a visual display unit with a capacity of 16 lines of 64 characters.

A Memory Plus board, costing £199, adds a further 8K bytes of RAM and allows for another 8K of EPROM (that's erasable programmable read-only memory) to be attached.

In addition, GR has launched a Pocket Terminal to act as a sophisticated keyed input device to Kim. The terminal is a hand-held device with 40 dual-purpose keys, giving a full ASCII character set, and costs £240.

On the software front, GR is supplying a wide variety of ready-written software for Kim1. This ranges from basic systems software such as Assembler / Disassembler / Editor, to a number of games programs.

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LS63	120
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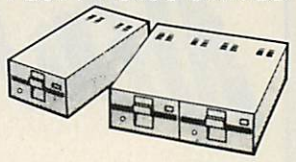

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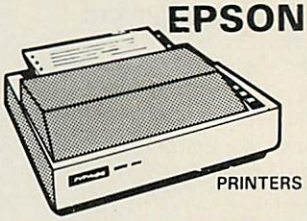

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32.768KH	100	16.0MHz	200
1MHz	275	18.0MHz	180
1.6MHz	392	18.432M	150
1.8MHz	395	19.968M	150
1.843M	200	20.0MHz	200
2.0MHz	225	24.0MHz	170
3.2768M	150	24.930M	325
3.57594	98	48.0M	175
3.6864M	300	100.0M	375
4.0MHz	150	100KHz	236
4.433619	100	1.28MHz	392
5.0MHz	150	2.4576M	200
6.0MHz	140	3.276MHz	160
6.144MHz	150	4.032MHz	290
6.5536M	200	4.194304	200
7.0MHz	150	4.80MHz	200
7.168MHz	150	5.185MHz	300
7.68MHz	200	5.24288	390
8.0MHz	150	7.7328M	250
9.0MHz	200	8.0833M	395
9.375M	350	8.86723	175
10.0MHz	175		
10.7MHz	150		
10.24MHz	200		
12.0MHz	175		
12.582M	300		
14.31818	170		

IDC CONNECTORS

Speed block type	PCB Plug with latch Strt Pins	PCB Plug with latch Angle Pins	Female Header Socket	Female Card Edge Connectors
10 way	90p	99p	85p	120p
16 way	130p	150p	120p	p
20 way	145p	166p	125p	195p
26 way	175p	200p	150p	240p
34 way	205p	236p	160p	320p
40 way	220p	250p	190p	340p
50 way	235p	270p	200p	395p

JUMPER LEADS Ribbon Cable Assembly DIL Plug (Headers)

Single Ended Lead 24" Long

Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	325p

Double Ended Leads

6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

IDC female receptacle jumper leads

	36" 20way	26way	34way	4way
1 end	160p	200p	260p	300p
2 end	290p	370p	480p	525p

DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	16p	52p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey	Colour
	Price per Foot	
10	15p	28p
16	25p	40p
20	30p	50p
26	40p	65p
34	60p	85p
40	70p	90p
64	100p	135p

DIL PLUGS (Headers)

	Solder	(IDC)
14 pin	40p	99p
16 pin	49p	105p
24 pin	88p	170p
40 pin	250p	265p

AMPHENOL PLUGS

24way IEEE	475p
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Parallel	485p

ZIF DIL SOCKETS

24way	575p
28way	850p
40way	975p

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	Female Strt Pins	Female Angle Pins	Male Strt Pins	Male Angle Pins
DIN41617 31way	170p	—	—	175p
41612 A B 2 - 32way	275p	—	220p	285p
41612 A C 2 - 32way	295p	340p	240p	300p
41617 A B C 3 - 32way	360p	385p	260p	395p

EDGE CONNECTORS

	.156"	.1"
TWO ROWS		
2 × 18way	145p	180p
2 × 22way	200p	199p
2 × 23way		185p
2 × 25way		225p
2 × 28way		210p
2 × 30way		245p
2 × 36way		295p
2 × 40way		315p
2 × 43way		395p

D CONNECTORS: Miniature

	9way	15way	25way	37way
Male				
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
Female				
Solder	110p	160p	210p	350p
Angle	165p	215p	290p	440p
Pins	150p	180p	240p	420p
Covers	85p	80p	80p	100p

IDC 25way 'D' plug 385p Skt 450p

● Circle No. 103

Acorn surcharges under attack

I SEE from the review of View in the April issue of *Practical Computing* that Acorn is at it again. When is Acorn going to get the message that customers don't like the hidden extras that always seem to be essential to Acorn BBC Microcomputer products.

The extreme example was, of course, machine itself. In order to get the early machines up to specification the 1.0 operating system had to be bought. Then there was the disc operating system — you could buy the chip but would have to pay extra to find out how to use it. Similarly, if you buy the Acornsoft Forth cassette you won't get a shred of documentation — not even a glossary — unless you pay extra. The latest example is View. You can have the word processor but if you want to print out anything subtle, of course, you have to pay extra. As John Harris said, "It is a wicked con . . . ". I wonder how many other Acorn BBC Micro products have the same sales trap.

Acorn's sales department seems to have gone out of its way to upset every section of its users — computer users, disc users, Forth users, etc. — which is a great pity because the BBC Micro system is good. If I were an Acorn hardware or software designer I might be sticking pins in wax models labelled "sales dept." by now.

G R Gilmore,
Warrington,
Cheshire.

Pet keywords

IN THE FEEDBACK column, April 1983, R J Dowling wrote concerning abbreviated keyword entry on Commodore machines. The ability to use abbreviated keywords has been known for some while and is well documented. However, for those readers not in the know I have given all the abbreviations that the Pet will allow.

The main advantages of using these abbreviated forms are that program entry is considerably faster and more than 80 characters can be put on one line of Basic text. For instance typing:

```
10goS93000:fOx = 32768to
  34768: pO(pE(x)aN128):nE:
  iN1,a$:dC:cAd1:goS2000:
  wA158,1,1:reT
```

when listed becomes:

```
10 gosub3000:forx = 32768to
  34768: poke(peek(x)and128):
  next: input£1,a$:dclose:
  catalogd1: gosub2000:
  wait158,1,1:return
```

The reason that these abbreviations work is that they fool the ROM routine, located at $B4FB in Basic 4 or $C495 in Basic 2, which tokenises the input buffer. Those wishing to know how it works should attack this area with a dissassembler.

Joe Arrowsmith,
Morden,
Surrey.

Abbreviated forms of Basic 4.0 keywords:

aB—Abs	pR—Print£	dO—DOpen	vE—Verify	lO—Load
cA—Catalog	rI—Right$	gE£—Get£	bA—Backup	pO—Poke
coL—Collect	sP—SPC(	lE—Let	cO—Cont	reS—Restore
dI—Dim	tA—Tab(	oP—Open	dE—Def	sG—Sgn
eX—Exp	aP—Append	reC—Record	eN—End	stR—Str$
hE—Header	cL—CLR	sA—Save	gO—Goto	wA—Wait
mI—Mid$	coP—Copy	sT—Stop		
?—Print	dL—DLoad	vA—Val		
reT—Return	gE—Get	aT—Atn		
sI—Sin	eF—Left$	cM—CMD		
sY—Sys	nO—Not	dC—DClose		
aN—And	rE—Read	dS—DSave		
cH—CHR$	rU—Run	goS—Gosub		
conC—Concat	sQ—Sqr	lI—List		
diR—Directory	uS—Usr	pE—Peek		
fO—For	aS—Asc	reN—Rename		
iN—Input£	clO—Close	sC—Scratch		
nE—Next	dA—Data	stE—Step		

When using the Commodore assembler development system editor the following abbreviations may also be used:

aU—Auto	cO—Cold	
fI—Find	kI—Kill	
bR—Break	cpU—CPut	
fO—Format	nuM—Number	
cH—Change	deL—Delete	
gE—Get	pU—Put	

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

Texas chips

MAY I THANK you for the fascinating innovation Chip-chat. We have plenty of articles about microcomputers, about software and about hardware modifications, but not so many about the chips themselves.

I was grateful to Ray Coles for his interesting article in the April issue reminding us of the Texas TMS-1000 and the new TMS-7000. The former is the most popular microprocessor in the world, but unless they have taken to pieces a washing machine, automatic sewing machine or one of those remote-control cars, I don't suppose most hobbyists would recognise the type number.

I would like to take issue, though, with Mr Coles damning with faint praise the flagships of Texas Instruments' microprocessor fleet, the 9900 family of 16-bit chips. Because the 9900 was the first 16-bit processor to appear it has been regarded as rather long in the tooth, at least by writers in the hobbyist press.

Industry, however, views it otherwise. This year the 9900 family has outsold all other 16-bit micro families. The 9995, the hybrid high-speed variant, looks like becoming the most popular 16-bit microprocessor in the world by May this year.

Unfortunately the personal computing section of the industry has ignored the 9995, apart from the Cortex computer produced by Powertran. At under £400 — £900 with twin discs — this computer offers faster benchmarks than the IBM PC, together with amazing graphics.

I understand that the latest addition to the 9900 family, the 99000, which is in many ways compatible with the 9995 both in software and hardware, has unbelievable benchmarks. Using Power Basic a prototype microcomputer using the 99000 carried out Benchmark 1 in less than 10 minutes and Benchmark 7 in less than 3 seconds. The corresponding figures for the IBM PC are 1.4s. and 37.4s. respectively. For Mr Coles to call the 9900 family "seven stone weaklings" does not bear close examination.

I might say that I have no professional involvement with Texas Instruments, but have watched the development of the Cortex with great interest and have helped Powertran's technical writers to produce the instruction booklet for the Cortex.

Roy Tipping,
Bedford.

Sony Typecorder

I ENJOYED reading "Computing on the Train" in the March issue, but as a veteran user of a Sony Typecorder I was frustrated by Ian Stobie's discussion of this machine, which to my mind completely misses the point. The problem is partly due to Sony's execrable documentation.

The Typecorder is a primitive word processor, but it is a splendid machine for doing rough typing under restricted conditions — on a train or plane, or in a library, or away from the office. The Typecorder should always be used in conjunction with a more sophisticated word processor, but the real news is that almost any microcomputer will do.

Although Sony sells an interface device which adds several hundred pounds to the price of an already expensive

(continued on next page)

(continued from previous page)
machine, the Typecorder can be fooled into sending out a standard 300 baud signal by shorting the sleeve of the communications plug to ground. I have soldered up a simple two-wire cable using a mono plug at one end and an RS-232 plug at the other, connecting the pin of the plug to pin 2 of the RS-232, and ground to pin 7.

I use the public-domain Modem communications program to accept the text into my North Star Horizon. For some reason, the Sony interface device is necessary with the Osborne 1.

Text from the Sony Typecorder is transferred perfectly to my Horizon. Saved on disc, it is easily edited with WordStar. The only extra steps are to remove several control characters with global find-and-replace ↑Q↑A functions, and to replace unwanted hard Carriage Returns ↑N with spaces to allow reformatting.

My belief is that the principal use of hand-held machines for all serious computer users will be as peripherals to larger machines with full-screen capability. This goes for the Epson HX-20, the Hewlett-Packard 75C, and the new Tandy Model 100, a less expensive machine which is loaded with communications ports and options.

Alan H Nelson,
Berkeley,
California.

Simpler filters

CONGRATULATIONS to Bill Hill on his article Recursive Kalman Filters in the April issue. He is to be commended for attempting to bring such a relatively high-flown mathematical technique within the reach of the home-computer owner.

Many such users need a gentler introduction to the practice of predictive filtering and they could profitably start with the alpha-beta or g-h technique. It is widely used in older radar installations and is described in *An introduction to Radar Systems* by Skolnik. It computes the smoothed value of a parameter $\bar{x}$ and its rate of change $\dot{\bar{x}}$ at the nth observation, from the following equations. The smoothed value is defined by

$$\bar{x}_n = x_{pn} + g(x_n - x_{pn})$$

The smoothed rate of change is defined by

$$\dot{\bar{x}}_n = \dot{\bar{x}}_{n+1} + h/T_s(x_n - x_{pn})$$

where x_{pn} is the predicted value at the nth observation; x_n is the measured value at the nth observation; T_s is the time from the last observation. The predicted value for the next observation (n + 1) is:

$$x_{p(n+1)} = \bar{x}_n + \dot{\bar{x}}_n \quad T_s$$

The variables g and h are the smoothing coefficients. Sometimes two are insufficient and a third equation is used to provide second-order smoothing.

Clearly if g = h = 0 predictions only are used. Conversely if g = h = 1 measurements are relied upon and predictions discarded. Within these limits, low values of g and h provide good smoothing of random errors — that is narrow filter bandwidth — while high values or wide bandwidth provide rapid response to sudden changes in the parameter under measurement.

The standard g-h filter compromises in favour of smoothing. There are many ways of computing the g,h coefficients. The following formulae are based on a least-squares method linear fit to the observed parameter values. This gives for the nth observation:

g = 2(n − 1)/n(n + 1)
h = 6/(n*(n + 1)

An adaptive filter is one which varies the smoothing coefficients to achieve a variable bandwidth appropriate to the changes in the observed parameter values. To simplify matters the coefficients can be related thus:

$$h = g^2/(2 - g)$$

The value of g is made dependent on the measurement error $x_n - x_{pn}$. Initially the bandwidth is made wide, and it narrows down if the parameter value changes in a smooth, linear manner. Unexpected or non-linear changes increase the measurement error and the bandwidth is widened.

The actual relationship between g and the measurement error depends on the circumstances of the particular application. In most cases a suitable empirical relationship can be found with a little trial and error. This simple approach would be the best starting point for someone wishing to apply these techniques to the smoothing of joystick inputs.

The Kalman filter, which is inherently adaptive, requires three models: for the parameter value changes, the uncertainty of disturbance in these values and errors in the measurement system. If the first model is linear and the other two are assumed Gaussian noise with zero mean, then the Kalman filter equations reduce to those of the g-h filter with the coefficients being continuously computed.

L G Westhead,
Scarborough,
North Yorkshire.

Kalman filters

THE ARTICLE by Bill Hill was very interesting and succinctly written. I have applications for a system which smooths signals so I was keen to try the program as a means of understanding just what is special about Kalman filters. Unfortuantely the program itself has confused me and I would be glad of comments on whether it is correctly listed.

I was unable to obtain graphs at all until I changed line 930 to:

```
IF K < = 279 THEN GOTO 580.
```

Both the graphs plotted were identical, following the movement of the paddle with some delay. The numbers plotted were marginally different, but the differences were too small to show on the graph. If I increased the variance of the input noise to 25 the two curves appeared more noisy, but again identical. If I increased the noise level by amending lines 660/680 the same thing happened: the noise levels increased but the differences between the graphs were too small to observe.

So is the filter doing what I want, namely picking out signals from noisy backgrounds, or am I missing the point?

Michael Brown,
Harrogate,
West Yorkshire.

● **Bill Hill replies:**
As I mentioned in the article, the Kalman filter's internal model, line 870 in the program, is assumed to be a deterministic model of the process. Hence it does not know explicitly about any noise in the system.

The correction in my letter printed in last month's Feedback Column makes this the case. Even with this correction, the values of the program variables X and XE should be, and are, close.

Mr Brown asks why the value of the state variable estimate, XE in the program, is so similar to the state variable, X in the program, for the thermocouple simulations. Putting aside the multivariable case, the whole point of the scalar Kalman filter is to remove the measurement noise, V in the program, and give a good estimate, XE, of the state variable X. Ideally, the values of XE and X would be identical. If XE is still noisy, it is simply because X itself is also noisy because of the noisy input to the system, U + W.

It seems to me that Mr Brown would like to remove measurement noise from a system which can be assumed deterministic — that is, one in which there is no process or input noise, only measurement noise. To illustrate what happens, try running my simulation program and set the input noise variance at zero and the measurement noise variance to 1.E+06. The filter gain becomes zero after a short while because, for a deterministic system with measurement noise only, the prediction $\hat{x}_k(-)$ made using the filter's internal model becomes the best possible estimate $\hat{x}_k(+)$ of x_k. If the values of the filter model parameters Φ^k and Δ were different from the actual system parameters, then $\hat{x}_k(+)$ would be biased. The non-zero filter gain for the first few time steps of the fully recursive filter allows the filter to quickly improve on the initial state estimate $\hat{x}_o(+)$.

Mr Brown's comment on an error in line 930 of the program listing is correct.

```
930 IF K < = 279 THEN GOTO
    580
```

The modifications that Mr Brown has made to lines 660, 670 and 680 are not really valid. The routine in lines 650 to 710 uses the central limit theorem to generate approximately Gaussian random variables from a non-Gaussian series of random numbers.

A lot of experimenting can be done with even a simple simulation program like the one given in the article. You may notice, for example, that the value of the filter gain depends

(continued on page 13)

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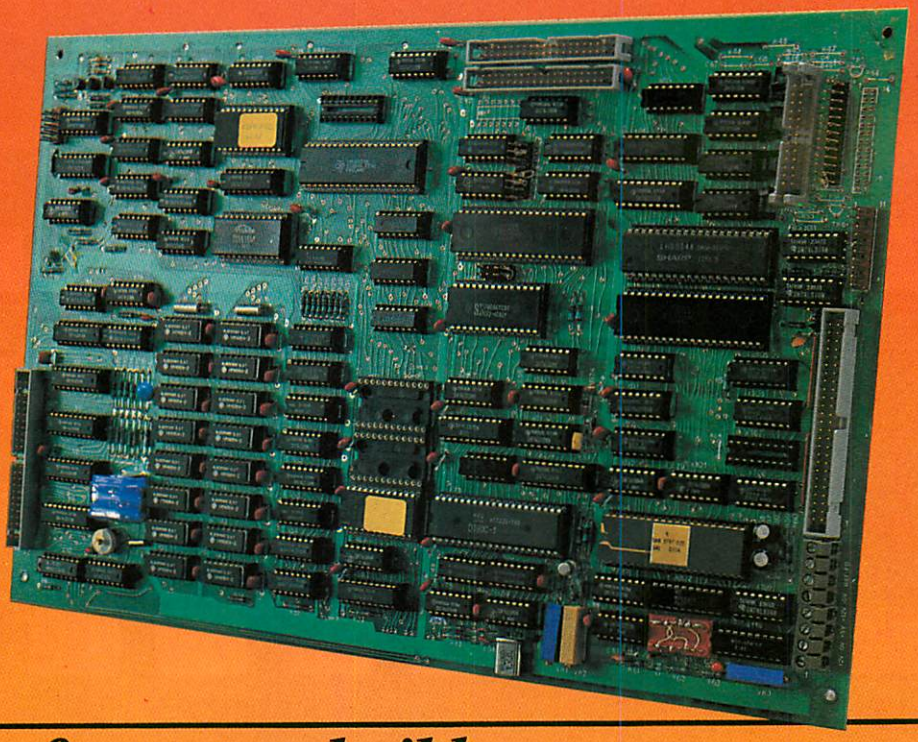
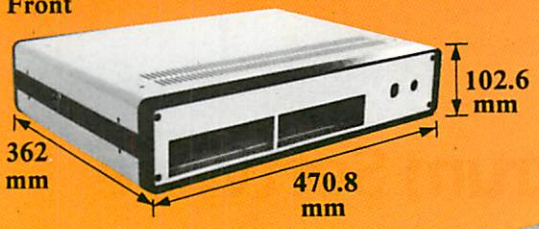


also available – for system builders

Front



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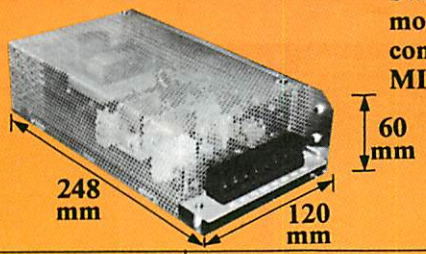

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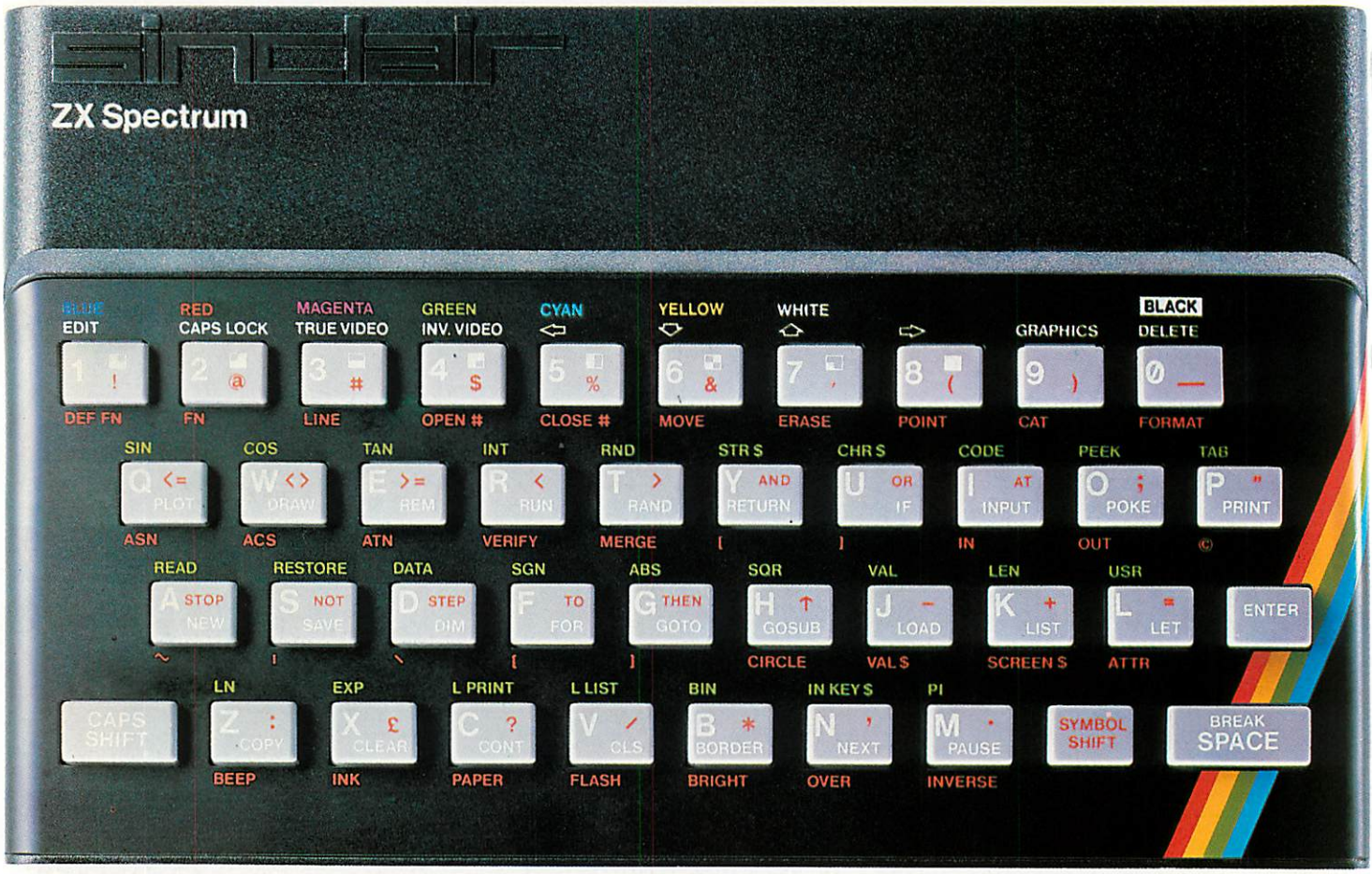
● Circle No. 104

Sinclair ZX Spect



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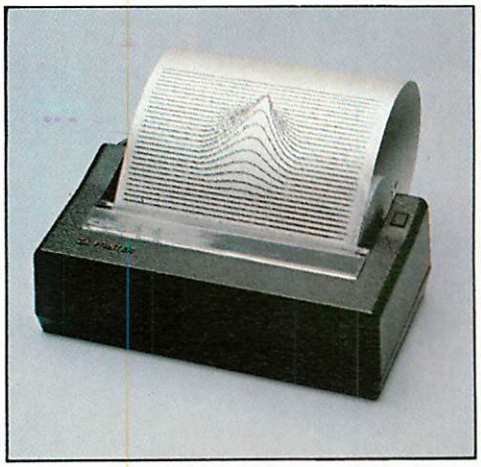

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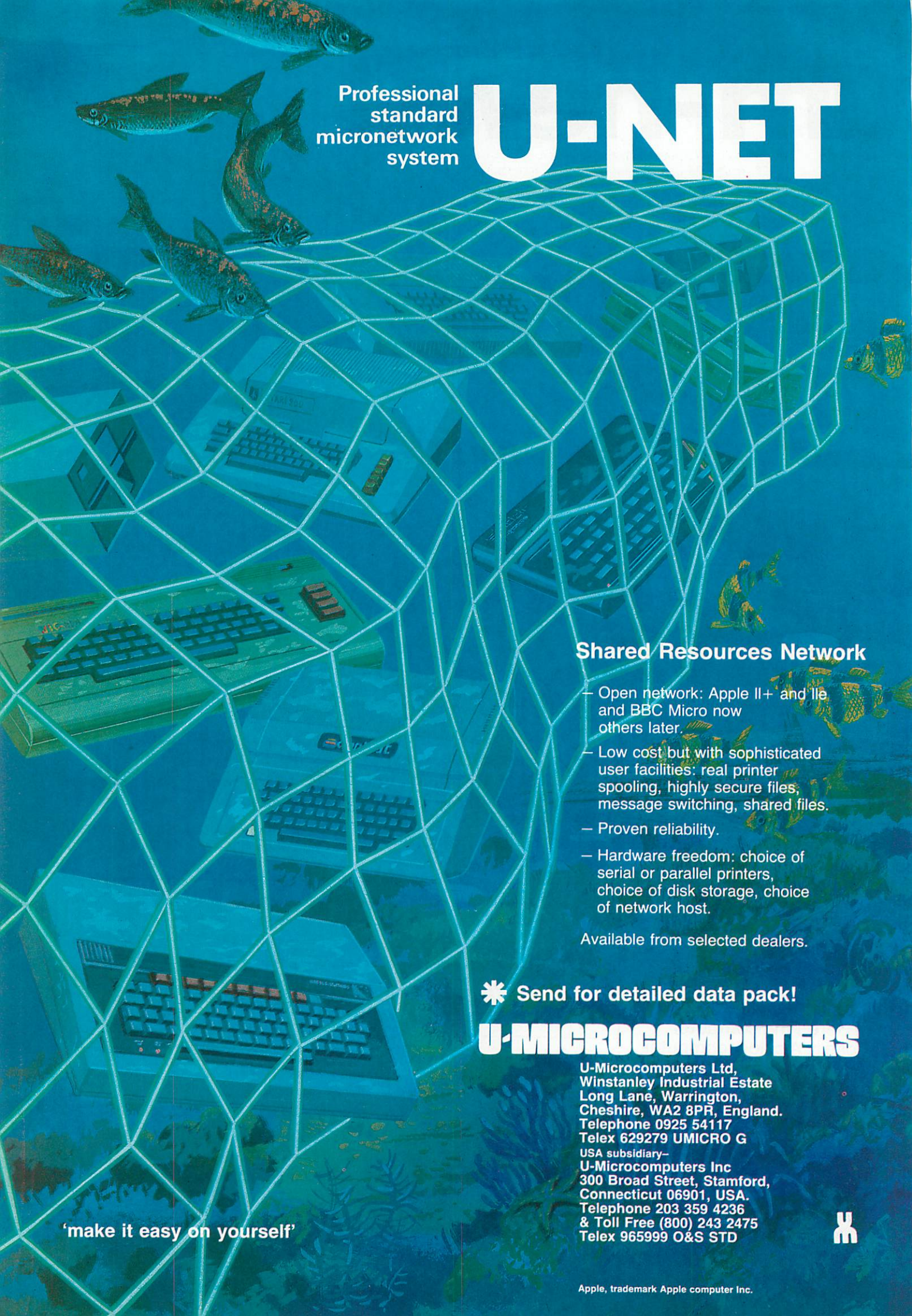
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(continued from page 8)
on the ratio of the noise variances, and therefore the same value of G will result if VI is 8 and VM is 0.0025, or VI is 24 and and VM is 0.0075.

I strongly recommend anyone interested in finding out more to read the book by Takahashi *et al* mentioned in my bibliogaphy. It is a good introduction to both scalar and multivariable Kalman filters. Another excellent book, geared to applications rather than theory, is *Applied Optimal Estimation*, edited by A Gelb and published by the MIT Press (1974).

Good loser

MY DISPLAY PROGRAM published on page 159 of the May issue contains an error. Line 60 should read:

```
60 Z% = ?(ADD%):ADD%
   = ADD% + 1
```

As published the program will display the next byte to that indicated on the screen.

My error must leave Ian Kerr — no relation — as the clear winner of John Harris's competition. The program was written in haste one evening and put away before fully tested.

As regards improvements, one of the main criteria was for a short program which I could use in conjunction with some machine-code programming to examine memory. The size of this program can be reduced still further by reducing the procedure lines 220 to 260 to a single line using the Eval function:

```
220 DEFPROC HEX (ADD$): IF
  ADD$ = " " THEN STOP
  ELSE ADD% = EVAL
  ("&" + ADD$): ENDPROC
```

Dr A K A Kerr,
Holly Lodge Comprehensive School,
Liverpool.

BBC sounds

I WAS INTERESTED to read David Peckett's article in the March issue about the Envelope and Sound commands in BBC Basic. His program is a useful one but contains one serious error. He states that if one of the pitch durations PN1, PN2 or PN3 is zero then auto-repeating of the pitch envelope stops and the pitch of the note continually cycles. This is not true.

In fact the effect is different in OS 0.1 from that in OS 1.0 and later versions. With the earlier version of the operating system, OS 0.1, a pitch duration of zero is treated as though it were 256. For short total durations this may well give the appearance of a continually cycling note, but for longer notes the pitch envelope does auto-repeat in the usual way.

This behaviour would appear to be an error is OS 0.1, and in later versions a pitch duration is treated as zero, and the pitch envelope simply moves on to the next element.

T M R Ellis,
Sheffield.

Traffic count

THERE WERE some minor errors in my article, Classroom Traffic Count, printed in *Practical Computing*, May 1983 issue. In the list of variables Y should be YY, and this alteration should then take place in the lines 300, 310, 320, 350, 360, 470 and 860.

The printout routine is only suitable for the Genie I. For a Tandy or Genie I suggest a Screen Print routine similar to the one published by G Grant in the May 1982 issue.

Frank Davies,
Warrington,
Cheshire.

Team effort

THANK YOU for your article in the May issue on the Orion, and my interview with Ian Stobie. I would like to stress that computer design is a team effort, not a one-man show. At FTS, and I hope other British companies, is a team of outstanding talent.

These young people have produced designs far superior to the American and Japanese competition, as your Benchmarks show. I would like your younger readers to look with pride at these achievements and to set their sights on educating and training themselves to continue this progress.

Martin Healey,
University College,
Cardiff.

Alias Anon

THANK YOU for publishing my contribution on Fast Array storage in May's Apple Pie. The only blemish on an otherwise excellent issue is that there was no mention of the contributor of the article.

P M Doherty,
Solihull,
West Midlands.

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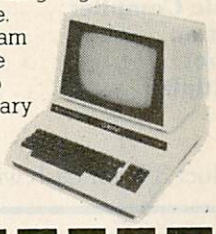

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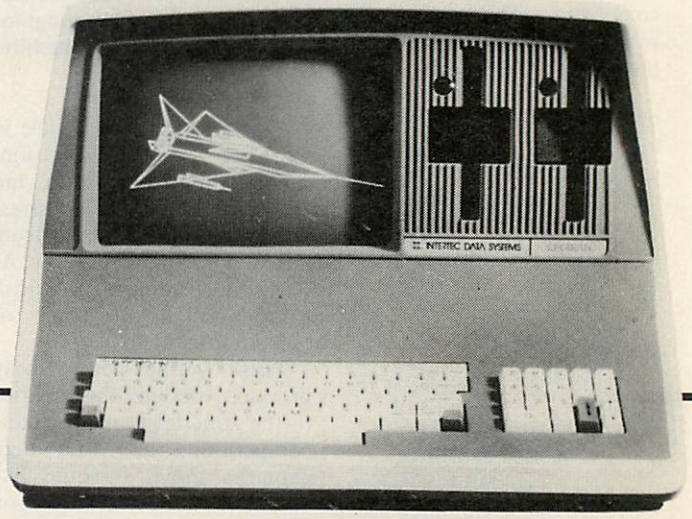

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This is the Sharp MZ-3541. It has two Z-80A processors in it, so it isn't exactly going to set the world on fire. However it does offer the user access to a wide range of tried and tested software through its CP/M 2.2. It is available in monochrome at £1,795 and colour at £2,450. For details contact Sharp Electronics. Telephone: 061-205 2333.

Buzby's micros

BRITISH TELECOM has launched a range of new microcomputers under its Merlin brand name. "New" means new to Telecom: the M-2226 Business Computer is, in fact, an ICL Personal Computer, which is perhaps better known in its original form as the Rair Black Box. The M-3300 word processor is more familiar in the guise of the Logica VTS, with its stylish casing designed by the now-defunct Nexos.

British Telecom has also launched a terminal which is also said to be supplied by ICL. That may well be so, but what BT does not tell you is that ICL gets it from Kokusai in Japan.

BT's new products are not just "badge engineering", however. They also have telecommunications facilities, which means they can be hooked up to the phone lines and, via a Puma teleprinter, the Telex nextwork.

The micros are also supplied with a "user-friendly" operating system. For the Black — er, M-2226 this is called Merlin Master and looks like a front end to CP/M. For the M-3300 it looks like a non-industry-standard OS.

In good company

YET ANOTHER 16-bit small business micro from Japan, the Duet-16 has a few things that set it apart from the crowd. It is small, has two 720K half-height floppy-disc drives and features an Intel 8086 processor.

While it does run MS-DOS, it is not IBM PC compatible though it will be possible for software houses to port IBM software to it.

Initial software includes

WordStar with colour, Multiplan, Basic, Cobol and some small business accounts packages — but no less could be expected. WordStar and Multiplan seem to make no use for the Duet's 16 function keys.

The price is, sadly, £2,595 plus VAT for the 128K RAM version with amber screen.

The Duet is made by Panafacom, a subsidiary venture of Fujitsu and Matusushita, in Japan. The U.K. distributor is Lambart Micro Computers, 52 Moorbridge Road, Maidenhead, Berkshire SL6 8BN. Telephone: (0628) 72037.

Galivan squeezes full-size features into a portable

A COUPLE of years ago industry pundits were saying that a full-featured business micro would be smaller and lighter than a portable typewriter by about 1986. The Gavilan fulfils the brief, because it is small enough to fit in a briefcase — but we have used a prototype and can affirm that it works now. Gavilan expects to have production models on sale in Europe in October this year.

The Gavilan micro is only 11.4in square by 2.7in. high and weighs a mere 9 lb. It has a full typewriter keyboard with numeric keypad, and a built-in eight-line by 66-character LCD display.

Inside is an Intel 8088 microprocessor which enables Gavilan to offer compatability — up to a point — with the IBM PC. The discs are not compatible, because the Gavilan sports a single 3in. micro-floppy with 320K of formatted storage.

Other features include 80K of RAM, expandable to 128K internally, built-in Modem and RS-232 ports, and enough battery power for an eight-hour working day. It also has ROM slots for Gavilan's Capsuleware software packages.

The most interesting aspect of the Gavilan is that it uses a Lisa-like operating system. It was written in Gavilan's own language and takes up only 48K.

The Gavilan portable micro has an add-on printer which uses a thermal ribbon and ordinary paper which combine to produce correspondence-quality results.

The Gavilan uses all the mouse-like commands and procedures but it does not have a mouse. Instead it uses a touch-sensitive panel situated above the keyboard: a finger movement here draws the arrow-shaped cursor across the screen. Having positioned it over, say, Zoom you give the panel a sharp tap to execute the command. It enables a great deal of work to be done calling up, manipulating and filing documents without using the keyboard.

Gavilan has also implemented MS-DOS for the new micro, and plans to offer CP/M and UCSD p-system operating systems. The aim is an "open development environment" to encourage software development.

In the short term Gavilan sees its major markets as being the vertical ones such as accounting, insurance, medical staff, travelling salesmen, journalists, etc., where business users have a need for portable computing.

The price is not, at first sight, low at around £3,000, including integrated software. But it is comparable to the IBM PC for a micro that offers similar power.

Contact Gavilan Computer Corporation, 240 Hacienda Avenue, Campbell, California Ca 95008. Telephone: (408) 379 8000.

(more news on next page)

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The Winchesters are available with either 5Mbyte, 10Mbyte or 15Mbyte of ready-formatted capacity. A single drive is housed in a unit that is a mere 4in. by 5.25in. by 1.5in. which is about the size of a paperback copy of *War and Peace*.

Networking is possible by using the ICE multiplexor in conjunction with one or more of these drives to give a central database accessible by up to 64 micros. For further information contact ICE Ltd, Littleton House, Littleton Road, Ashford, Middlesex. Telephone: (07842) 47271.

Midland Fair Highlights

THE FIRST EVER Midland Computer Fair, held in the centre of Brimingham, brought the excitement of the London show to England's second city. Over 16,000 local enthusiasts, business people and schoolchildren passed through the doors over the four days of the show.

The accent of the show was on software, with hundreds of thousands of microcomputer programs being sold to members of the public and distributors alike.

There were two compilers for the Sinclair ZX Spectrum on show at the fair. One using a subset of the micro's native Sinclair Basic was being shown by Softek. The other, proudly demonstrated by Swindon-based Hisoft, was a full Pascal compiler. Called Pascal 4T, the compiler adheres to the definition of the language as given by Jensen and Wirth. The package will run on any Z-80 based micro, but there is a special Spectrum version which supports that machine's colour graphics.

Many retailers at the show commented on a demand for Oric and Lynx software, but there was little to be seen. In fact there was a great deal of confusion concerning the pricing of the Oric computer which could be bought on a number of different stands, each offering a different price.

Users of the BBC and Dragon computers were able to purchase some software, but the widest range of programs available was for the Spectrum. Among the stands with Spectrum software were Quicksilva, DK Tronics, and New Generation.

Small business systems were also a feature of the show. Among the machines on show were the Sirius 1, Olivetti M-20 and Televideo 803. Horizon Software was showing a number of packages written in Cobol for the 803, which will also run on any CP/M system. Meanwhile Junction 1 Computing, a local Sirius supplier, was demonstratin the Pulsar Software that runs on the machine.

Spectrum RAM pack

THE CHEETAH 32K Spectrum RAM pack converts the £99 16K Spectrum to a 48K version. It fits on the back of the micro in such a way that the notorious "RAM pack wobble blues" of the ZX-81 simply do not apply, and it is fully compatible with all other Spectrum accessories.

Cheetah RAM packs are fully guaranteed and are currently available for £39.95 by mail order from Cheetah Marketing Ltd, 359 The Strand, London WC2R 0HS. Telephone: 01-240 7939.

Free books

DIGITAL EQUIPMENT CORPORATION has produced a book called *Guide to Personal Computing*, which it is giving away free to anyone who wants a copy. It is an undisguised ploy to get you to part with lots of money for one of DEC's excellent computers, which feature heavily inside, but it is an interesting book filled with pictures and good detailed explanations about what DEC perceives the personal computer to be. The text has been angliscised, so you can allow kids to read it without picking up bad habits. For your copy of the Digital *Guide to Personal Computing* ring DEC on Basingstoke (0256) 59200.

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CUBE-Universal Control by Eurocomputer

CUBE is ***THE*** comprehensive Eurocard Computer system. Over the past two years, many of Britain's top industrial companies have been quietly and efficiently using CUBE modules in their small-scale computer control projects.

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The fundamental choice is between 6502 and 6809 microprocessors and the newly-available 68000. Each choice is fully supported with efficient assembly language development tools, and with high-level languages for really quick programming. The range is extended by a continuing programme of industrial computer development, and by compatibility with Acorn Eurocards. Similarly, the CUBE cards can be used as extensions to the BBC computer.

The Cube Systems

All CUBE systems are delivered to the customer configured to his exact requirements, and tested in that arrangement. An appropriate text editor, machine code assembler and high level language are included with each system, as our experience has shown that most applications demand these tools, and the CUBE systems offer just about the most cost effective development station available.

The Software Products

Each of the three processor options 6502, 6809 and 68000 have associated machine operating systems, disk operating systems, and machine code assemblers.

On 6502, the user has a choice of a 10k version of ROM or disk BASIC with built-in screen graphics commands, or a 12k version called ICOL which provides real time control of inputs, outputs and timers.

On 6809, the disk operating system offered is FLEX, under which a wide variety of languages may be used, such as Pascal, BASIC, and PL/9. The advantage of PL/9 is that while it is similar to BASIC in ease of use and quickness of implementation, the final program is compiled, and therefore is much faster in operation than interpretive BASIC, and does not require the purchase of an interpreter for each implementation. A 2k version of tiny BASIC on ROM is also available.

BASIC is available on 68000.

The Hardware Products

EUROCUBE. The complete system on one small card. Available with either 6809 or 6502, and supplied complete with two channels of serial i/o, 20 channels of digital i/o, four memory sockets, each of which can take up to 32KB of ROM, EPROM or RAM, and a battery back-up circuit which provides non-volatility for CMOS RAM.

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CU-MEM. Universal Memory Carrier board for ROM, EPROM and RAM up to 8KB per device, with 2 banks of four 28 pin memory sockets and battery back-up circuit for CMOS RAM.

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CU-MOT. 6802 single board computer for study purposes, without machine or disk operating systems, or languages support.

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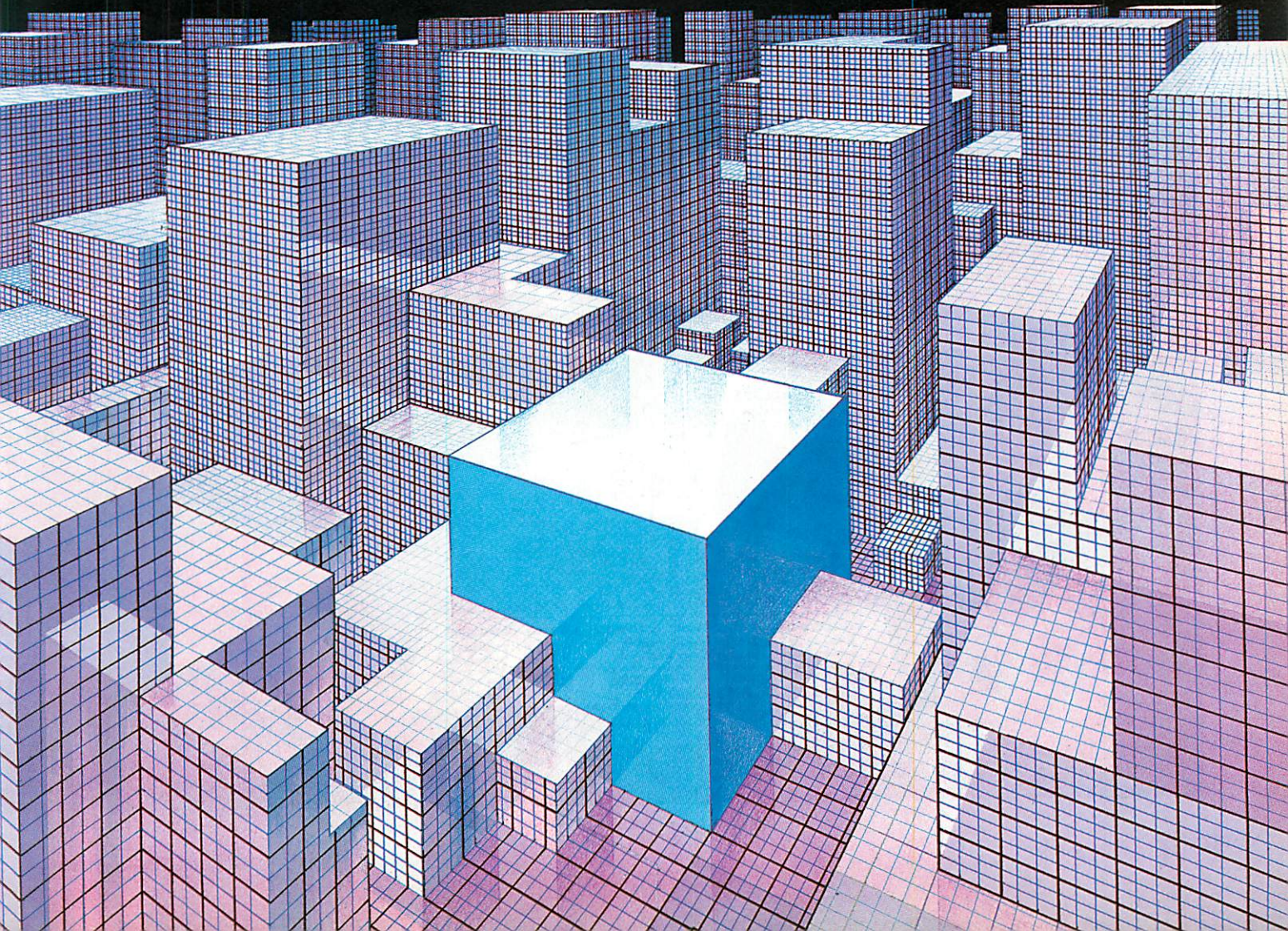

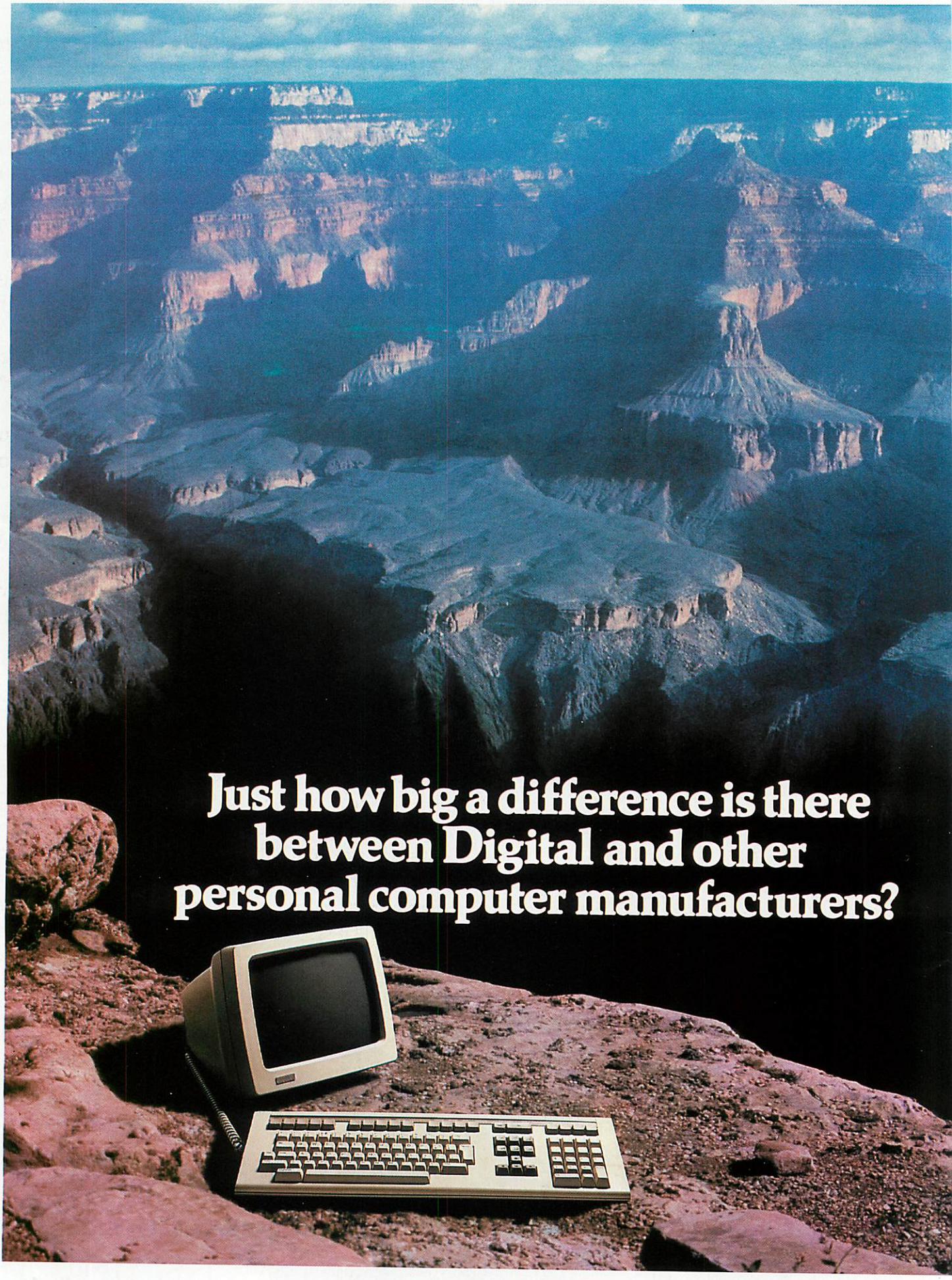
Just how big a difference is there between Digital and other personal computer manufacturers?

The gap, believe us, is wide.

And the confusion surrounding personal computers, widespread. Because the term 'personal' computer now stretches to include a multitude of machines, with a diverse range of functions and capabilities.

So let's set the record straight. And get down to business. Over the past quarter century Digital's main objective has been to personalise the computer. Permitting direct access to *real* computing power to whoever wants it.

And in that time Digital have introduced minicomputer power into banks, mines, steel plants, farms, refineries, aviation, broadcasting, universities and assembly lines to name but a few.

Digital were also the first company to mass produce minicomputers, and the PDP-11 is, in fact, the world's most popular minicomputer today.

A fact that makes Digital the world's largest manufacturer of minicomputers. Which, in turn, makes it less of a surprise that Digital have now developed a range of personal computers unrivalled in their ability to meet today's professional requirements. From the dual microprocessor Digital Rainbow to the highly advanced Digital Professionals, the first personal computers with the ability to perform numerous functions at once, there's a Digital personal computer to suit practically any need.

And the Digital difference becomes even wider when you consider Digital's unique service back-up, which includes access to our Customer Information Centre, service support, software services and maintenance. And in the unlikely event of anything going wrong, Digital guarantee to deal with any problem, on site, within 8 working hours anywhere on the UK mainland.

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If you'd like further information about Digital professional personal computers ring Digital on Basingstoke (0256) 59200 or contact any of the Dealers shown overleaf, then compare the facts with any other machines to see just how wide that chasm of difference really is.

You'll end up on our side every time.

Doing more. The Digital difference.

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● Circle No. 111

Where to find your nearest Digital Authorised Personal Computer Dealer.

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115 Fulham Road, London SW3.
Tel: 01-581 8134.

The Computer Terminal, 44 Cathedral Place,
London EC4. Tel: 01-236 2187.

Demotab Ltd.,
99–101 Regent Street, London W1.
Tel: 01-439 3971.
(Market Research & Advertising Agencies).*

Guestel Ltd., 8–12 New Bridge Street,
London EC4. Tel: 01-583 2255.

Matmos Electronics Ltd.,
14–16 Child's Place, London SW5 9RX.
Tel: 01-373 6607.
(Opticians & Opthamologists).*

Micro Business Systems PLC, Cannon Street,
London EC4. Tel: 01-621 1122.

Personal Computers Ltd., 220–226 Bishopsgate,
London EC2M 4JS. Tel: 01-377 1200.

Planning Consultancy Ltd., 46/47 Pall Mall,
London SW1Y 5JG. Tel: 01-930 5274.

Rank Xerox (UK) Ltd., The Xerox Store,
84 Piccadilly, London W1V 9HE.
Tel: 01-629 0694/5.

The Xerox Store, 110 Moorgate,
London EC2M 6SU. Tel: 01-588 1531/2.

The Xerox Store, 76–77 Holborn,
London WC1V 6LS. Tel: 01-242 9596/7.

Software Sciences, Thorn (EMI) House,
14 Old Park Lane, London W1. Tel: 01-499 7099.

Software Sciences, 88 Old Street,
London EC1. Tel: 01-253 1480.

Sumlock Bondain Ltd., 263–269 City Road,
London EC1V 1JX. Tel: 01-250 0505.

Sytec Products Ltd.,
25 Bruton Lane, London W1. Tel: 01-409 1244.
(Pressure Vessel Design, Surveying,
Structural Analysis).*

HOME COUNTIES

Dataview Ltd., Portreeves House, East Bay,
Colchester, Essex CO1 2XB. Tel: 0206 865835.

Ferrari Software Ltd., 683 Armadale Road,
Feltham, Middlesex. Tel: 01-751 5791.

GSI Ltd., Stanhope Road, Camberley, Surrey.
Tel: 0276 62282.
(Motor Dealers & Manufacturers).*

Key Computer Centres, Enterprise House,
Terrace Road, Walton-on-Thames, Surrey.
Tel: 09322 42777.

Micro Business Systems PLC,
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Tel: 07535 55211.

Microfacilities Ltd., 7–9 Church Road,
Egham, Surrey. Tel: 0784 31333.

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Essex CM20 2BP. Tel: 0279 443421.

Sytec Products Ltd., Cord House,
The Causeway, Staines, Middlesex.
Tel: 0784 63911.

SOUTH/SOUTH EAST

Bartholomews Business Systems Ltd., Portfield,
Chichester, Sussex. Tel: 0243 775111.
(Agricultural Suppliers, Farming).*

Computerland
(Sperrings Computer Shops Ltd.),
Spencer House, 12–14 Carlton Place,
Southampton. Tel: 0703 39571.

Software Sciences, Abbey House,
282–292 Farnborough Road, Farnborough,
Hants. Tel: 0252 544321.

South East Computers Ltd.,
Unit 2, Castleham Road,
Castleham Road Industrial Estate,
Hastings, Sussex. Tel: 0424 426844.

South East Computers Ltd., 29 High Street,
Maidstone, Kent. Tel: 0622 681263

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Computacenter, Theatre Square, Swindon,
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Rank Xerox (UK) Ltd., The Xerox Store,
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Bristol BS99 7AX. Tel: 0272 277828.

15 Castle Street,
Software Sciences, Unit 39, Southfield Road,
Nailsea, Nr. Bristol. Tel: 0272 851462/3.

South Coast Computers Ltd.,
South Coast House, Wimbourne Road,
Ferndown, Dorset. Tel: 0202 893040.

Whymark Computing, 20 Milford Street,
Salisbury, Wilsthire SP1 2AP.
Tel: 0722 331269.

MIDLANDS

4B Microcentres Ltd., 13/14 North Bar, Banbury,
Oxon OX16 0TF. Tel: 0295 66555/50796.

Micro Business Systems PLC, Wirksworth,
Derbyshire. Tel: 062-9823120.

MMS Ltd., Ketwell House,
75–79 Tavistock Street, Bedford MK40 2RR.
Tel: 0234 40601.

Zygal Dynamics PLC, Zygal House,
Telford Road, Bicester, Oxon OX6 0XB.
Tel: 08692 3361.

NORTH EAST

Microware Computers Ltd., Diamond House,
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Microware Computers Ltd., Priory House,
1133 Hessle High Road, Hull HU4 6SB.
Tel: 0482 562107.

Whessoe Technical & Computing Systems Ltd.,
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Co. Durham DL3 6DS. Tel: 0325 60188.

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Cytek (UK) Ltd., Sandringham House,
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Rank Xerox (UK) Ltd., The Xerox Store,
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Liverpool L2 9QR. Tel: 051-236 7512.

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Rank Xerox (UK) Ltd., The Xerox Store,
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Cardiff CF1 1EW. Tel: 0222 40118.

Sigma Systems Ltd., 266 North Road,
Cardiff CF4 3BL. Tel: 0222 34865/69.

SCOTLAND

Micro-Centre (Complete Microsystems) Ltd.,
30 Dundas Street, Edinburgh EH3 6JN.
Tel: 031-556 7354.

Micro Business Systems PLC,
Turnhouse Airport, Edinburgh.
Tel: 031-333 1000.

Pilgrim Business Machines Ltd.,
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Tel: 031-226 5528.
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Pilgrim Business Machines Ltd.,
Northfield Place, Aberdeen. Tel: 0224 645104.

Rank Xerox (UK) Ltd., The Xerox Store,
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Tel: 041-333 0495.

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Tel: 023-134 2117.

DIGITAL UK HEADQUARTERS

Digital Equipment Co. Limited, P.O Box 110,
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● Circle No. 112

Personal Basic heralds increased competition

DIGITAL RESEARCH and Microsoft are moving further into complete across-the-board competition with the latest flurry of product announcements. Time was when Microsoft wrote the language interpreters and Digital Research the operating systems, but things have not been the same since the arrival of IBM and the 16-bit micros.

Since Microsoft obviously wants people to use its MS-DOS 16-bit operating system in preference to Digital Research's CP/M-86 it is not surprising that Microsoft has attached low priority to bringing out up-to-date versions of its languages to run under CP/M-86. Recent machine reviews have frequently had to criticise the inability of particular implementations of Microsoft MBasic on brand-new 16-bit machines with masses of RAM to address more than 64K of the memory. Meanwhile Microsoft has been bringing out all sorts of wonderful programming tools making full use of 16-bit hardware to run under MS-DOS.

Digital Research has been responding vigorously by writing its own languages and development tools: DR Logo, for instance. The latest development is a new DR Basic, Personal Basic. It will run on any of its 16-bit operating systems which include CP/M-86 and Concurrent CP/M-86. DR claims that it can execute MBasic source code with little or no modification, easing the transfer of existing applications across from the Microsoft product. Programs written in Personal Basic can address 1MByte.

Personal Basic is aimed primarily at the first-time computer user. Digital Research expects computer professionals to prefer the existing CBasic and CBasic compiler. To that end Personal Basic comes with both a reference and a tutorial manual. It has a full-screen editor, syntax errors are flagged at program-entry time with intelligible error messages, and extensive debugging features.

Personal Basic costs £100 and should be available from Digital Research dealers immediately.

In another move to counter Microsoft, Digital Research has announced an agreement with VisiCorp to suppport its VisiOn operating environment as the standard graphics-oriented user interface for use with applications running under CP/M operating systems.

VisiOn is an integrated multi-purpose package from the maker of VisiCalc which uses high-resolution graphics and another of those mice. Digital Research and/or VisiCorp can be expected to bring out a range of programming tools to make the VisiOn window manager and mouse interface available to third-party software producers.

Digital Research U.K. Ltd can be contacted at Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB.

Epson HX-20 phone hook-up

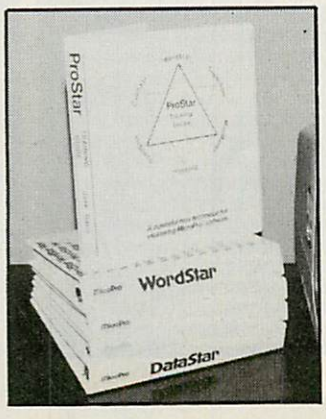
TO BE ABLE to wander around the country gather information to send through the telephone system to a computer back at base requires the right combination of hardware and software. You need a portable computer, the appropriate software package and a compatible acoustic coupler with you on your travels, plus a suitable system at the base end of the link.

The battery-powered Epson HX-20 portable computer has always looked highly suitable for this kind of application, and products are now emerging to support it in this role. The acoustic coupler from Norbain Micro is battery powered: Norbain Micro has adapted the popular Sendata unit to run off the HX-20's own internal battery power supply.

Intext is a compatible text-editing package. Running on the unexpanded Epson machine, Intext leaves 5.5K of memory for the user to enter text into. With the Epson expansion unit fitted this goes up to 21.6K.

Text can be previewed on the built-in printer, sent to a larger printer via the Epson's RS-232 interface, or dispatched through the phone system. Intext can be used with an ordinary mains-powered Sendata acoustic coupling Modem, or with the battery-powered Norbain adaptation of it.

Intext costs £50, and the Norbain acoustic coupler £240. Both products can obviously be used independently of each other for other applications. Details from Talbot Offset, 61 Heathwood Road, Talbot Park, Bournemouth BH9 2J7, telephone (0202) 519282; and from Norbain Micro Ltd, Norbain House, Boulton Road, Reading, Berkshire RG2 0LT, telephone (0734) 752201.



The ProStar Training Guide covers all six Micropro packages — WordStar, Mailmerge, Datastar, Spellstar, Supersort and Calcstar — in one volume. The 220-page guide adopts a tutorial approach aimed at the beginner, and gives special attention to how the packages can be used together. The guide costs £29 and is available from Micropro dealers or from Jane Davis Publications, Hillcrest, The Avenue, Farnham Common, Buckinghamshire SL2 3JS.

Schools programs

GOOD EDUCATIONAL software from commercial suppliers has been in surprisingly short supply, considering the obvious need for it. Maybe the prospect of illicit copying by the underfunded but highly organised users in schools has put the companies off.

The rapid rise in the number of home computers is changing the situation. There is now a rush of new educational titles which seem to be intended primarily for use in the home. Most of them get away from the overtly didactic approach, and instead resemble games.

Chalksoft specialises in educational software and has a range of programs for the BBC, Spectrum and Vic. Details from Chalksoft, 37 Willowslea Road, Northwick, Worcester. Telephone: (0905) 55192.

In the game-like but demanding Microbe, the player or players pilot a miniature submarine round the human body to fight off disease and repair damaged organs. There are several levels, so the beginner can build up skill and knowledge.

Microbe costs £34.95 plus VAT and requires a 48K Apple II with one disc drive and games paddles. Contact Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 212321.

(more news on page 24)

G. W. COMPUTERS LTD LONDON'S WEST END NATIONWIDE OVERNITE SERVICE MORE PRODUCT RANGES BETTER SERVICE PROBABLY THE WIDEST SELECTION OF NETWORKS... MICROS...AND PRINTERS ON DISPLAY NATIONWIDE

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*****FEATURES*****

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User-defineable reporting	random/binary/key/multiple field search	User-defineable files/field words/sizes
field protection/classification	'if-then' questioning	endless 'either-or' matching
either-or. same as. greater. smaller	file protection/password entry	formulate/recall on selection criteria
sorts 'alpha or numeric' any window	range match. not match. integer match	13 interrogation question types
12 online file architectures	sort speed 500 records per 20 seconds	short filing output/audit trails
		Word-star & Mbasic compatible

DBMS III.7 NEW SWITCH MODE FACILITY ENABLES YOU TO CROSS UP TO 12 DIFFERENT FILES (32000 RECORDS PER FILE) PRE-SELECTING ANY OF UP TO 20 FIELDS PER RECORD/FILE FOR DISPLAY/PRINT OUTPUT (240 FIELDS) IN ALL. ONE MASSIVE ENQUIRY CAN PASS THROUGH 384,000 RECORDS

You might have two files whose records are directly related to each other, so that the first file (say containing names and addresses) refers to the second file (say financial and other information relating to the same record numbers in the first file) directly. Then you can simply select that in file 1 you are interested in just the name and telephone numbers, whereas in file 2, you are interested in the income, trading period and number of branches, information. Your enquiry can then pass through both files highlighting that information only. Actually there doesn't need to be a strict correlation between the same record numbers in different files, and you can also on just one JUMP command go to any record in any of the 32000 records in any of the twelve files and carry on cross-referencing from there onwards.

DBMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER

Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulated any task you wish to program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "analysis"; "patient history analysis"; "research-analysis"; "budgetting-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Not only does this program surpass most of its kind that you might buy elsewhere, but if you buy the hardware from us, then you get it FREE . . . DBMS II (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) AND MS-DOS (tm) I.E.: SIRIUS/VICTOR/IBM DBMS II IS £395.00 (or £250.00 by mail order ex. training) . . . DBMS III is £575.000 (or £295.00 by mail order ex. training).

MICRO-COMPUTERS

INTERTEC	-Superbrain 64K RAM/320K disks	1895.00
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(exc DOS)	-Advantage 64K RAM/5.3M disks	£3095.00
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All computer prices include mbasic as standard.
All prices marked * are 8/16 bit machines.

WE STOCK MOST OF THE BEST KNOWN SOFTWARE ALSO MOST OF THE BEST KNOWN BRANDS OF PRINTERS & PERIPHERALS FROM 300.00 TO 2700.00 (OKI/EPSON/DRE/NEC/QUME/ANADEX/RICOH)

SOFTWARE COMMENT!!!
INTEGRATED SOFTWARE IS PROPERLY REPRESENTED, when the degree of integration reflects the ability to refer to as many different files, as well as employ as many different functions, under as many different modes as possible in one program only. This principle not being observed, will confer upon your purchases the attribute of their being expensive as an aggregate even though individually they are cheap. "DBMS III.7" and "THE KEY" are comparably worthy of such a label.

SYSTEM DEAL (our speciality) SAVES YOU 1500.00+

Buy any computer, any printer and 150.00 value diskettes add £85.00 for cables and testing.
add 10% for return to base warranty for 1 year (optional)
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and get completely *****FREE*****

cpm handbook	50 basic exercises	2000 sheets paper
DBMS III.7	magic wand w/proc	magic calc
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library boxs	disk/games	DT/AS/NS sorts

Total Value £1525.00

Based on 8 bit hardware, 16 bit software varies.

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software described above ***** FREE *****	3025.00

We specialise in 'STANDARD MICRO-PRINTER SYSTEMS' as well as 'NETWORK SYSTEMS BASED ON A SHARED HARD DISK'.

The range of computer products (mostly ex stock) includes the most popular brands of micro-computers, printers, modems, buffers, spoolers and software.

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NEC	-3510 R/O	1495.00
	-7710 R/O	2195.00
	-5520 KSR	2250.00
DRE	-8820	1295.00
	-8830	1695.00
TEXAS	-810	995.00
	-825	995.00
DIABLO	-630	1995.00
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	-18 Meg hard disk	2995.00
RODIME	-6 Meg hard disk	1495.00
	-12 Meg hard disk	1950.00
GENIE	-5MG fixed/5MG removeable disk	3295.00
QUADRAM	-64K print spooler/copier	295.00
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GIX	-port expander (switcher)	95.00

NOTE: Corvus drives with multiplexor may network sirius . . Superbrain . . Concept . . PET . . Victor . . IBM . .

SOFTWARE

G.W.L.	-BUS V8.00 (Accounts)	275.00
	-DBMS II (Database)	*£395.00
	-DBMS II (by mail order only)	*£250.00
	-DBMS III (database)	*£575.00
	-DBMS III (by mail order only)	*£295.00
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	-Sales Ledger	*£95.00
	-Purchase Ledger	*£95.00
	-Nominal Ledger	*£95.00
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Each module is a set of 'task disks' designed for minimal learning curve. This software derives from modules of 'DBMS III' and runs reports without your secretary having to touch a single key

Consider the advantages in these features: The user manual is contained in FIVE pages. All reports are generated by robot functions. Reliability tested (benchtest PCW June). Works in a network multi-user environment Fast easy data entry. Files are re-organised and sorted automatically. Produced by the same people that originated 'BUSiness' 'DBMS II', 'DB-CALC', 'AUTOLOAD AND RECOVER' 'ETC' and sold successfully over the past five years.
Also see our advertisement next page.

The G80/86 networks

Based upon one hard disk and multiplexor module the G80/86 networks feature full network sharing of data resources by adding different stations that may be as various as Sirius/Victor 9000f/IBM/Superbrain/Pet/N'star/Sanyo. We also have a special 'spooler module' as well as software controllable port expanders and modems for output to telephones, printers, and screens so that a number of terminals may share the resources of one printer, as well as be able to send files over the telephone at any time (day/night) to both store on the hard disk and print out as well.

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When you budget for a complete system of software you eventually end up with a host of packages like, Sales, Purchases, Nominal, Data, Text, Calc, Mailshot, Invoice, Order, Workflow, Personnel, and so on.
The list is endless and the outlay several thousands of pounds.

Features.	Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left delete right, tab right-left-up-down' Paint your form as you like directly on the screen.
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Here's an example of an invoice you might design for your stationery .....
You could design your own spreadsheet, order form, statement, or any other kind of form that is required to fit your existing stationery.

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To £<1>£££££££££££ £<2>£££££££££££££ £<3>£££££££££££££ £<4>£££££££££ £<5>£££££££	From: G.W. Ltd 55 Bedford Court Mans. Bedford Avenue London W.C.1. Tel: 01-636 8210

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Quantity	Description	Cost	Tax	Total
<9>£££	<10>£££££££££££	<11>£££	<12>£££	<13>£££
<14>£££	<15>£££££££££££	<16>£££	<17>£££	<18>£££
	and so on...			
	Total...<19>£££££	Tax...<20>£££		

<??> items <1 >to <5 >internal command to request name input, and then search an address file for details.
<??> items <6 >to <7 >request date input and validate.
<??> item <8 >request agent number and validate range.
<??> <9 >request quantity, validate range.
<??> <10>request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility, you can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.

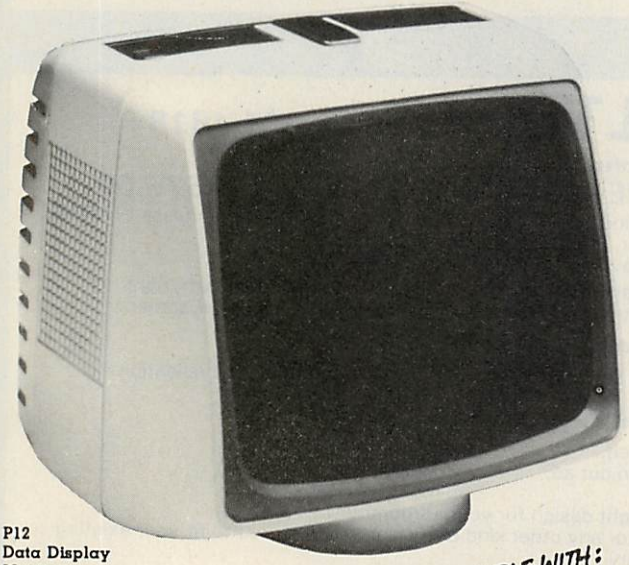
EG: Send fields <0 >, <1 >, <6 >, <7 >, <11>, <12>, <13>, <19>, <20> to a sales ledger.
Then send fields <9 >, <10>, <11>, to product analysis file.
Then send fields <0 >, <1 >, <7 >, <19>, <20> to V.A.T. file
Then send fields <10>, <11>, <12>, <13> to Nominal ledger.

● Circle No. 113

PHOENIX Data Display Monitor

THE TRUE LOW COST, EUROPEAN ALTERNATIVE!

The Phoenix Technology new breed of precision display monitor, offers an exceptionally high standard of performance and reliability at a true low cost.



P12
Data Display
Monitor

Specifications:
Input:
Composite video with loop through facility.
1v into 75ohms
CRT-Colour:
Green P31,
Orange P33
Band width:
24MHz measured at 3 db down
Display area:
210mm — horizontal
150mm — vertical
Scan frequency:
15.750 — horizontal
50Hz — vertical
Power consumption:
25 watts

PLUG COMPATIBLE WITH: NASCOM-APPLE-BBC MICRO -OSBORNE (WITH ADAPTOR) AND MANY OTHERS!

If you think you are paying over the odds for just another monitor, call and see the Phoenix range.
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● Circle No. 114

Spectrum Pascal

HISOFT PASCAL 4 is a Pascal compiler for the Spectrum. It is a true compiler producing Z-80 machine code, so a program produced with it will run very much faster than the equivalent program written in ZX Basic.

The compiler supports the ZX Printer and Spectrum graphics and sound facilities. Hisoft claims its Pascal implementation is close to standard Pascal as defined in the Wirth and Jensen Pascal user manual and report, and has all the standard data structures except files.

Pascal 4 costs £25 from Hisoft at 60 Hallam Moor, Liden, Swindon, Wiltshire SN3 6LS. Telephone: (0793) 26616. Hisoft also has a new version of its assembler package for the Spectrum, Devpack 2 — cost £12.50.

Microsoft breeds mouse

FOLLOWING the interest created by Apple's Lisa system and Visicorp's VisiOn, which both use mice to control the user interface, it emerges that Microsoft too is unable to resist the lure of the cute little furry creatures.

Microsoft's mouse, is held in the hand and rolled around the desk top to move a cursor around the screen. It has two buttons on it, which can be pushed to initiate actions.

Mice really come into their own with 16-bit machines, and are just part of a user-interface philosophy developed over the last 12 years, mainly at Xerox's Palo Alto research centre. The approach demands high-resolution graphics and uses ikons, the name given to graphics symbols on the screen representing currently valid actions the user can take.

The importance of the development lies in the software Microsoft is including with the mouse. The standard mouse driver software supports all Microsoft's high-level languages, including Basic, Pascal and Fortran. The application programmer will not have to worry about the details of producing a highly friendly style of interaction with the user.

The mouse comes in two versions, both costing £140. The IBM PC version has a plug-in board, and Microsoft promises immediate availability in the U.K. The second version is for any computer running MS-DOS which has a standard RS-232 interface.

The disc has on it, apart from the device driver, three demonstration programs to help the user build up skill at using the mouse. The source code is provided so that programmers can see how the system calls are handled.

Database for beginners

ASHTON-TATE of dBase II fame is following the current fashion for ridiculous software names and calling its new product Friday!. It is a database-management system designed to be easier for the first-time user than the company's best-selling dBase II. It supports up to 60,000 records which can be indexed on any field. Files produced by dBase II applications can be read by the new package and vice versa. It costs £190.

More details can be had from Ashton-Tate, 1 Lancaster Park, Richmond, Surrey TW10 6AG. Telephone 01-948 3111.

Challenger to WordStar

MICROSOFT has demonstrated a new word-processing package which is hoped to be sufficiently advanced to knock Micropro's WordStar off its perch. WordStar is probably still the top-selling word-processing package despite being rather long in the tooth.

Multi-tool Word is competitively priced at £275. It adopts the same style of interaction with the user as Microsoft's highly successful Multiplan spreadsheet. Data can be transferred between the two packages, and Microsoft intends to add further compatible applications to the range.

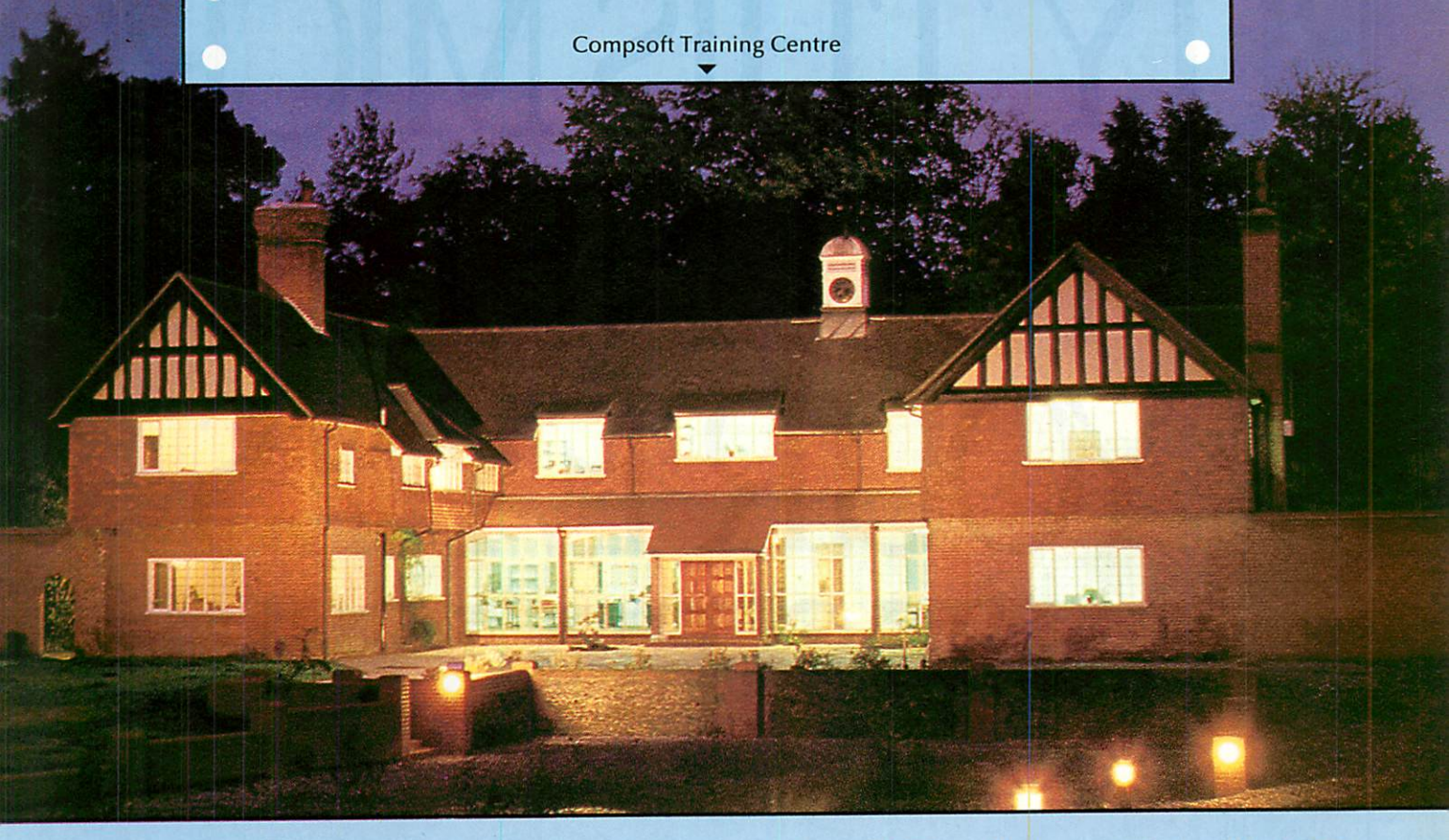
Although Multi-tool Word works quite happily with a standard keyboard, it has been designed to take full advantage of the mouse if you have one. Microsoft is offering the two products together at a special price of $350. Multi-tool Word should be available in August, and runs under MS-DOS.

COMPSOFT'S DMS – winner of the 1982 RICA Awards, 'Software Product of the Year'.

Now Compsoft announce Delta – the **very** powerful, **very** friendly database* that the world has been waiting for.

* For micro computers with CP/M, MP/M or MSDOS operating systems. Including IBM PC.

Compsoft Training Centre



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Compsoft DMS is already Britains No. 1 record keeping program. And with 4000 users to our credit, we can honestly say we know more about information storage & retrieval than anyone else. We listen to your comments & requests and now we've produced a world first – the Delta – a true transactional database.

If you'd like to know more, we have general brochures, full technical specifications & free guides to DMS handling a multitude of business situations from order processing, invoicing & stock recording, through to library, personnel & hospital record management.

Find out more about the database revolution. Either telephone the office or clip the coupon now.

Compsofts Delta – taking microcomputers into the third dimension.

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Hallams Court
Shamley Green
Nr Guildford, Surrey
England GU4 8QZ
Telephone: Guildford (0483) 898545
Telex: 859210 CMPSFT

COMPSOFT

● Circle No. 115

"GORDON SAYS IF YOU DON'T BUY THIS MICRO YOU NEED YOUR EYES TESTING."

"It's time to introduce a new breed of business micro – the Duet-16.

What you get is a performance that no computer its size has ever been able to offer.

For a start, you won't have to be an expert to make the most of its superior intelligence.

Whether it's accounts or business management, word-processing or stock control, the Duet-16 will give you the solutions.

This isn't magic. It's simply the new power of true 16-bit processing. And this is combined with the progressive technology of a World leader in computing.

So you can rest assured that every detail has been carefully considered.

For example, the pin-sharp screen and colour graphics are decidedly easier on the eyes.

And the memory is big enough to leave other micros green with envy.

However, even with all this performance it still won't swamp your desk. The Duet-16 measures a mere 16" x 13". And with a separate low-level keyboard you can work in your own style.

And all this comes for around the price of an everyday 8-bit.

But don't take Gordon's word for it. See for yourself."

Lambart

We've worked hard to be the best.

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Tel: 0628 72037/74916. Telex: 848635 LAMCOM G

● **Circle No. 116**

OUT-GUN THE COMPETITION WITH NEC CRT's.

NEC in-line gun colour display tubes offer you all the advantages. They come with deflection yoke already prealigned at the factory, thus enabling sharper focus and stable colour purity.

Inherent self-convergence eliminates any need for correction or re-adjustment.

Fine phosphor dot pitch gives outstanding clarity and high contrast, as shown in our range of tubes from .21mm super high resolution to .38mm medium resolution. The NEC standard for high resolution is .31mm.

29.1mm diameter neck ensures low power consumption. Special anti-reflection surface treatments and a wide range of phosphors, ranging from medium short to long persistance, are also available.

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Tel: (0735) 224474

NEC Electronics (UK) Ltd,
116 Stevenston Street,
New Stevenston
ML1 4LT, Scotland
Tel: (06981 732221 Telex 777565
NEC Corporation.

● **Circle No. 117**

Character recognition

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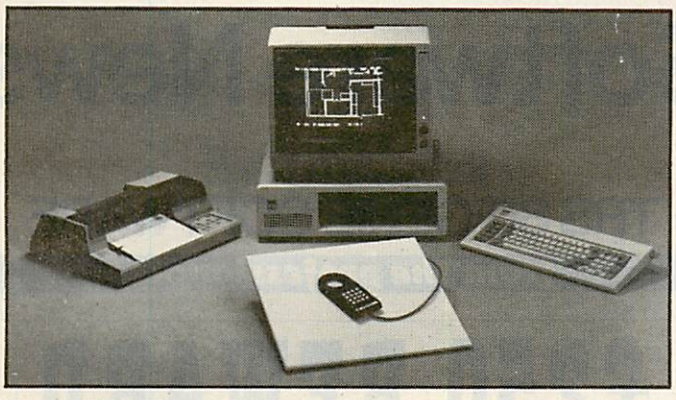

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The Sirius version requires a minimum of 256K and costs £790 plus VAT, complete with manuals, extra keycaps and a program-protection dongle. The documentation of the IBM version is expected to be ready in two months time, but the price has not yet been fixed.

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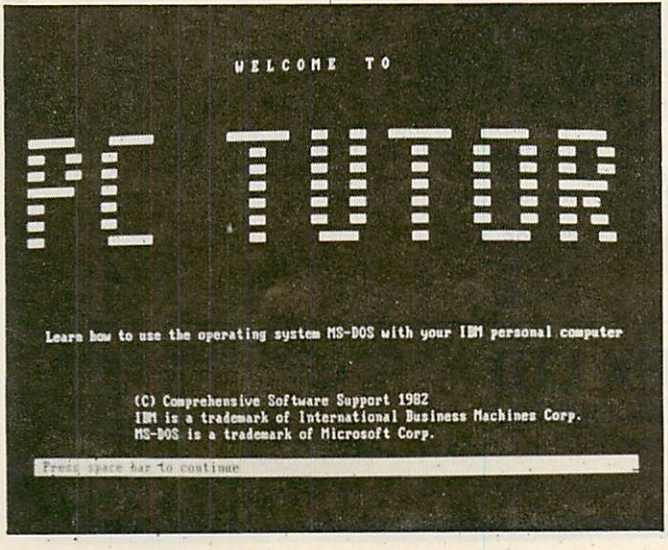
An 8088 card is also available in the U.S. for the Atari 800 with the ATR 8000 CP/M maker.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Learn how to use the operating system MS-DOS with your IBM personal computer
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Computer-aided teaching

THERE'S SOMETHING not quite right about learning computing from a book. If computers are that good for education, then computer learning should come from computer-aided teaching.

Such packages have been available for the small Atari and Commodore micros for some time. Now there's one for the IBM called PC Tutor.

It consists of a manual plus a disc which takes you step by step through the keyboard layout and functions, PC-DOS commands and utilities, right through to asynchronous communications. It is menu-driven so you can skip the more boring topics.

PC Tutor was written by Comprehensive Software of Los Angeles, and costs £59 plus VAT direct from Pete & Pam Computers. It is also being distributed in the U.K. and most European countries by the software consultancy CACI International. CACI also has educational packages for WordStar, dBase II, VisiCalc, Easywriter and Multiplan.

Contact CACI International, CACI House, 89 Fleet Road, Fleet, Hampshire GU13 8PJ. Telephone: (02514) 22133.

Software News

INNOVATIVE
TRS 80-GENIE SOFTWARE

from the professionals

£250 REWARD

Below you will find described a new program entitled Enigma. It is a true simulation of the German wartime cypher machine of that name. It will encipher messages which may be communicated to third parties by any means who, assuming they have the key, will be able to use their Enigma program to decipher.

We will pay the sum of £250 to anyone [who has purchased the program] who can demonstrate an infallible method of deciphering the coded message supplied in the program's instructions. We consider Enigma to be the best program of its kind on the U.K. or U.S. market; contestants may therefore use any orthodox means to crack the code, including microcomputer programs other than Enigma.

The original message and keys will be lodged with our Solicitors for safe keeping in a sealed envelope. In the [hopefully] unlikely event that the code is cracked by more than one person, the reward will be paid to the first customer who demonstrates to us that he has succeeded.

MOLIMERX LTD.

During the 1939/45 war the German Army and Intelligence used a deciphering machine called Enigma. It was a fascinating machine and the stories that have surrounded it are equally interesting. There have been some four or five books written about the machine, and with regard to the way in which the British counter intelligence managed to crack the code.

That they did so was the culmination of some fortuitous circumstances, a lot of luck, but mainly it was due to the fact that the people who did it were extremely clever mathematicians. The fact that it took so much brain power, plus a rudimentary type of computer and a specimen of the machine in order to crack the code is an indication of how complex that code is.

The Enigma microcomputer program that we are selling is a simulation of the original machine, together with one or two improvements which were suggested by Gordon Welchman, who wrote the book "The Hut Six Story" last year and was also the leader of the team that cracked the code.

Although the machine and, therefore, the program is so complicated, its use is amazingly simple. One simply inputs a key and a message and the code is supplied. To decipher, the message is input again with the key and if the key is correct then the decoded message is displayed. With the cassette version it is necessary to input from the keyboard but with disks both inputs and outputs may be to disk files if required. A printer is of course supported.

The code may be transmitted in any way which the written word can be transmitted. Companies who wish to fully protect their communications will no doubt have the program generate the code and then tap it into a telex. Tape users will have to send either the output from their printer or write down the code direct from the screen.

Enigma is a fascinating program designed, not only for those people who are interested in encryption professionally or as a hobby, but also for companies or private persons who wish to communicate with others in an entirely secure manner. As is shown by the above Reward Notice, we have great faith in the powers of this piece of software.

ENIGMA (Tape) ... **£17.25**
ENIGMA (Disk) ... **£23.00**
Inclusive of V.A.T. P&P 75p

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TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 plus £1 postage.

● Circle No. 118

California dreaming

Carl Peterson takes time out from Disneyland to visit the National Computer Conference in Anaheim, California.

WHILE THE IBM Personal Computer dominates the American market, portable computers continue to appear. Some of them are, of course, IBM PC work-alikes. To the Dynalogic, Dot, Compaq and Corona models must now be added yet one more — the Columbia VP.

Columbia Data Products has already become well known for its IBM PC look-alike — *Practical Computing,* March 1983. The portable version has a built-in 9in. monitor and 128K of RAM, but only one expansion slot. The price is attractive, at $2,995 including software. The software includes the Perfect range of Writer, Speller, Filer and Calc, plus MS-DOS with "RAMdisc", Fastgraphs, Home Accountant Plus and Space Commander.

A cheaper portable that also comes with software is the Pied Piper. It costs $1,299 and, again, comes with the Perfect range. It weighs only 12.5lb., but then it has only one drive and no display. As a Z-80 machine, it has only 64K of RAM.

The Access Matrix is another Z-80 based offering, though it sports four other microprocessors too. It comes with software including, yes, the Perfect range like the previous two.

The main selling points are that it has a built-in dot-matrix printer, built-in acoustic coupler, two floppy-disc drives and a 7in. amber monitor. It runs for one hour from rechargeable batteries, or from the mains. The price: $2,495.

Microdyne Computer Systems has gone a different route with its MCS-100 portable micro. As you might guess from the name it is an S-100 machine. It has an eight-slot bus with four slots empty for expansion. This Z-80 micro has 256K of RAM, one floppy and one 46Mbyte hard disc, 9in. green screen and built-in Modem.

Sharp's new portable is a 16-bit model using the Intel 8088 with 128K of RAM and 192K of ROM. An optional extra is 128K of bubble memory. This 11lb. portable has an 80-character by eight-line LCD display plus a built-in 80-column thermal printer, and a Modem.

The typewriter keyboard is done to a good standard — which has not always been the case with Sharp — but what the PC-5000 lacks is, oh dear, a disc drive.

It would have been a good machine if only it featured a micro-floppy. Still, it keeps up the current Japanese tradition of having something significantly wrong with every microcomputer product.

Among the many new non-portable Japanese micros shown was an interesting model from Sord. The M-68 is a compact dual 16-bit/eight-bit machine with both Z-80 and Motorola 68000 microprocessors.

One of the less exciting aspects of the design is that the 68000 CPU has 256K of RAM while the Z-80 has its own 64K of RAM. As an eight-bit machine it runs Sord's Pips, but not as a 16-bit machine.

A somewhat smarter-looking new micro is the Mitsubishi Model 816, which is that company's second go at a 16-bit micro. Where the Multi-16 sported an 8088, the 816 uses an Intel 8086.

The styling is a reasonable copy of the DEC Rainbow 100, but Mitsubishi has missed out on IBM PC compatibility. The Model 816 offers not MS-DOS but M/PM-86. The best it can offer for software transportability is a transfer from 8in. IBM EBCDIC format to a 5.25in. ASCII format.

The Z-80 based Access Matrix with built-in printer.

Sharp PC-5000: no disc drives.

WINCHESTER CP/M SYSTEM BREAKS THE £2000 BARRIER.

THE COUNTRY C3000 SERIES

Whether the requirement is for graphics using the new Tektronix® 4010 emulation under CP/M,* or for use as a powerful Word Processor, the C3010 with 10 MBytes of Winchester disk storage must be one of the most cost effective CP/M systems currently available.

Extensive use has been made of the entire range of Z80 peripheral devices, therefore the chip count is low and with only five major components, reliability is guaranteed.

Background diagnostics continuously run while the processor is idle performing RAM checks and logging disk retries. All status information is stored on files on the Winchester and can be accessed by the user if so desired.

A range of VDU's and printers is available either from Country Computers or it's dealer network, to compliment the C3000 series. And is available NOW!

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- 5, 10, 15, MBYTE WINCHESTER
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- Z80A 4MHZ PROCESSOR
- 64k RAM (256k RAM OPTIONAL)
- 16k PROM (32k PROM OPTIONAL)
- TWO SERIAL INTERFACE
- CENTRONICS PARALLEL INTERFACE
- BRITISH MADE
- MP/M OPTIONAL
- REMOVEABLE-MEDIA WINCHESTER DRIVES OR INTEGRAL TAPE-BACKUP UNITS OPTIONALLY AVAILABLE

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Tel: 0527 29826. Telex: 337497 Fistex G.C.C.L.

● Circle No. 121

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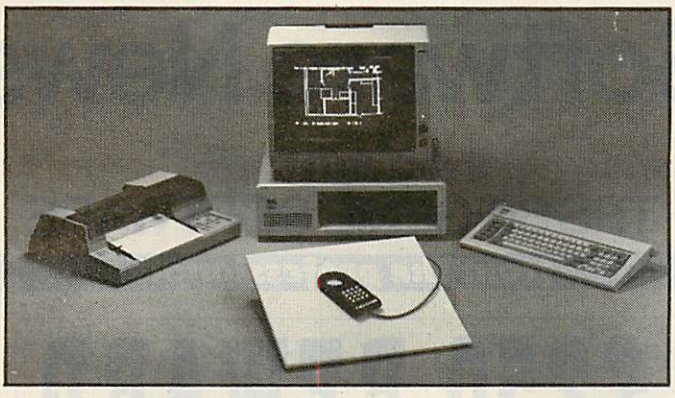

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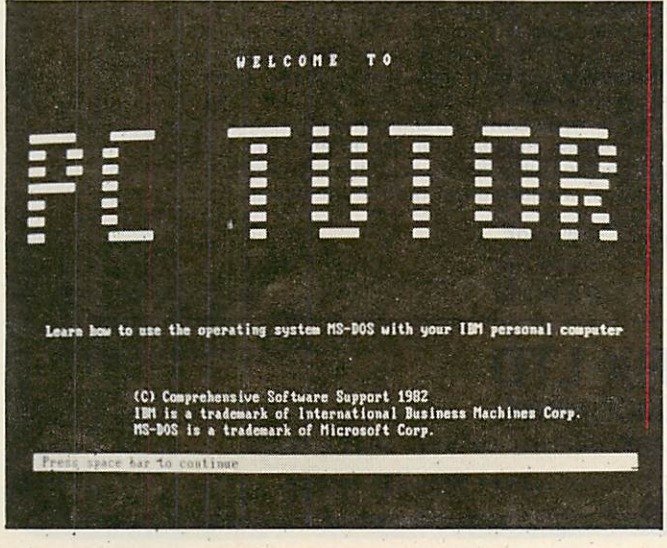
WELCOME TO
PC TUTOR
Learn how to use the operating system MS-DOS with your IBM personal computer
(C) Comprehensive Software Support 1982
IBM is a trademark of International Business Machines Corp.
MS-DOS is a trademark of Microsoft Corp.
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Such packages have been available for the small Atari and Commodore micros for some time. Now there's one for the IBM called PC Tutor.

It consists of a manual plus a disc which takes you step by step through the keyboard layout and functions, PC-DOS commands and utilities, right through to asynchronous communications. It is menu-driven so you can skip the more boring topics.

PC Tutor was written by Comprehensive Software of Los Angeles, and costs £59 plus VAT direct from Pete & Pam Computers. It is also being distributed in the U.K. and most European countries by the software consultancy CACI International. CACI also has educational packages for WordStar, dBase II, VisiCalc, Easywriter and Multiplan.

Contact CACI International, CACI House, 89 Fleet Road, Fleet, Hampshire GU13 8PJ. Telephone: (02514) 22133.

Software News

INNOVATIVE
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Below you will find described a new program entitled Enigma. It is a true simulation of the German wartime cypher machine of that name. It will encipher messages which may be communicated to third parties by any means who, assuming they have the key, will be able to use their Enigma program to decipher.
We will pay the sum of £250 to anyone [who has purchased the program] who can demonstrate an infallible method of deciphering the coded message supplied in the program's instructions. We consider Enigma to be the best program of its kind on the U.K. or U.S. market; contestants may therefore use any orthodox means to crack the code, including microcomputer programs other than Enigma.
The original message and keys will be lodged with our Solicitors for safe keeping in a sealed envelope. In the [hopefully] unlikely event that the code is cracked by more than one person, the reward will be paid to the first customer who demonstrates to us that he has succeeded.

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During the 1939/45 war the German Army and Intelligence used a deciphering machine called Enigma. It was a fascinating machine and the stories that have surrounded it are equally interesting. There have been some four or five books written about the machine, and with regard to the way in which the British counter intelligence managed to crack the code.

That they did so was the culmination of some fortuitous circumstances, a lot of luck, but mainly it was due to the fact that the people who did it were extremely clever mathematicians. The fact that it took so much brain power, plus a rudimentary type of computer and a specimen of the machine in order to crack the code is an indication of how complex that code is.

The Enigma microcomputer program that we are selling is a simulation of the original machine, together with one or two improvements which were suggested by Gordon Welchman, who wrote the book "The Hut Six Story" last year and was also the leader of the team that cracked the code.

Although the machine and, therefore, the program is so complicated, its use is amazingly simple. One simply inputs a key and a message and the code is supplied. To decipher, the message is input again with the key and if the key is correct then the decoded message is displayed. With the cassette version it is necessary to input from the keyboard but with disks both inputs and outputs may be to disk files if required. A printer is of course supported.

The code may be transmitted in any way which the written word can be transmitted. Companies who wish to fully protect their communications will no doubt have the program generate the code and then tap it into a telex. Tape users will have to send either the output from their printer or write down the code direct from the screen.

Enigma is a fascinating program designed, not only for those people who are interested in encryption professionally or as a hobby, but also for companies or private persons who wish to communicate with others in an entirely secure manner. As is shown by the above Reward Notice, we have great faith in the powers of this piece of software.

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● **Circle No. 118**

California dreaming

Carl Peterson takes time out from Disneyland to visit the National Computer Conference in Anaheim, California.

WHILE THE IBM Personal Computer dominates the American market, portable computers continue to appear. Some of them are, of course, IBM PC work-alikes. To the Dynalogic, Dot, Compaq and Corona models must now be added yet one more — the Columbia VP.

Columbia Data Products has already become well known for its IBM PC look-alike — *Practical Computing*, March 1983. The portable version has a built-in 9in. monitor and 128K of RAM, but only one expansion slot. The price is attractive, at $2,995 including software. The software includes the Perfect range of Writer, Speller, Filer and Calc, plus MS-DOS with "RAMdisc", Fastgraphs, Home Accountant Plus and Space Commander.

A cheaper portable that also comes with software is the Pied Piper. It costs $1,299 and, again, comes with the Perfect range. It weighs only 12.5lb., but then it has only one drive and no display. As a Z-80 machine, it has only 64K of RAM.

The Access Matrix is another Z-80 based offering, though it sports four other microprocessors too. It comes with software including, yes, the Perfect range like the previous two.

The main selling points are that it has a built-in dot-matrix printer, built-in acoustic coupler, two floppy-disc drives and a 7in. amber monitor. It runs for one hour from rechargeable batteries, or from the mains. The price: $2,495.

Microdyne Computer Systems has gone a different route with its MCS-100 portable micro. As you might guess from the name it is an S-100 machine. It has an eight-slot bus with four slots empty for expansion. This Z-80 micro has 256K of RAM, one floppy and one 46Mbyte hard disc, 9in. green screen and built-in Modem.

Sharp's new portable is a 16-bit model using the Intel 8088 with 128K of RAM and 192K of ROM. An optional extra is 128K of bubble memory. This 11lb. portable has an 80-character by eight-line LCD display plus a built-in 80-column thermal printer, and a Modem.

The typewriter keyboard is done to a good standard — which has not always been the case with Sharp — but what the PC-5000 lacks is, oh dear, a disc drive.

It would have been a good machine if only it featured a micro-floppy. Still, it keeps up the current Japanese tradition of having something significantly wrong with every microcomputer product.

Among the many new non-portable Japanese micros shown was an interesting model from Sord. The M-68 is a compact dual 16-bit/eight-bit machine with both Z-80 and Motorola 68000 microprocessors.

One of the less exciting aspects of the design is that the 68000 CPU has 256K of RAM while the Z-80 has its own 64K of RAM. As an eight-bit machine it runs Sord's Pips, but not as a 16-bit machine.

A somewhat smarter-looking new micro is the Mitsubishi Model 816, which is that company's second go at a 16-bit micro. Where the Multi-16 sported an 8088, the 816 uses an Intel 8086.

The styling is a reasonable copy of the DEC Rainbow 100, but Mitsubishi has missed out on IBM PC compatibility. The Model 816 offers not MS-DOS but M/PM-86. The best it can offer for software transportability is a transfer from 8in. IBM EBCDIC format to a 5.25in. ASCII format.

The Z-80 based Access Matrix with built-in printer.

Sharp PC-5000: no disc drives.

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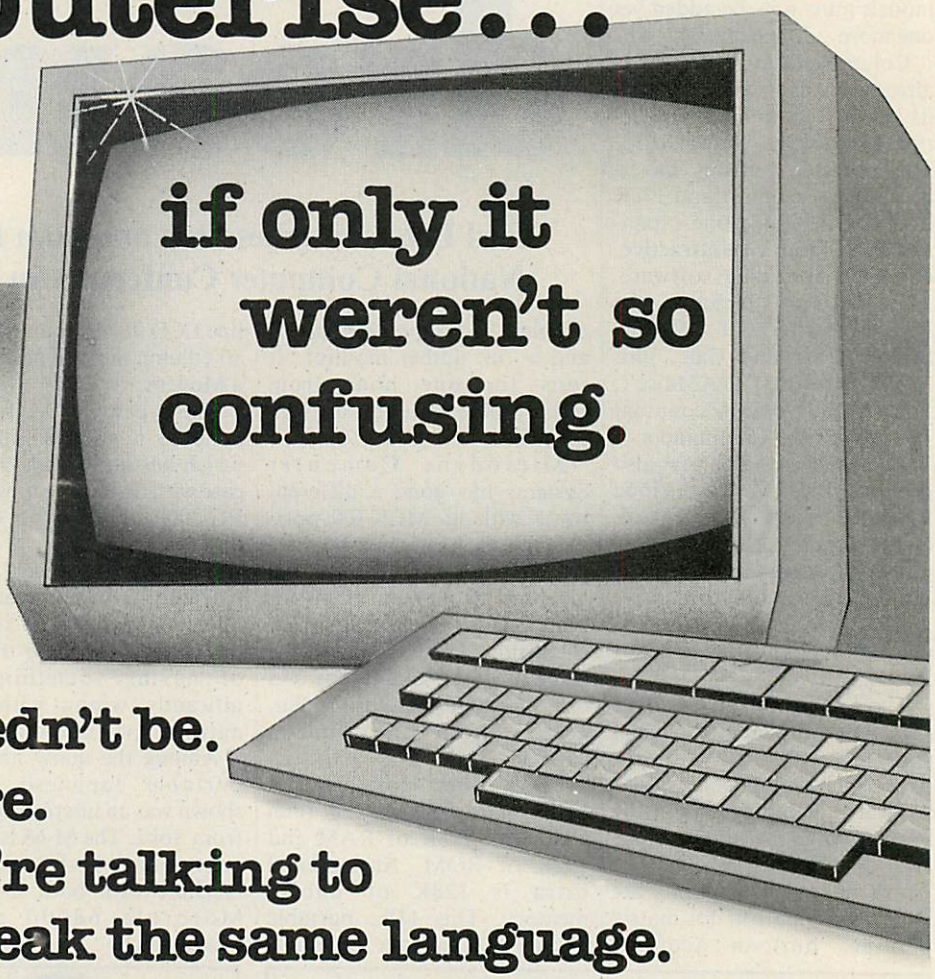

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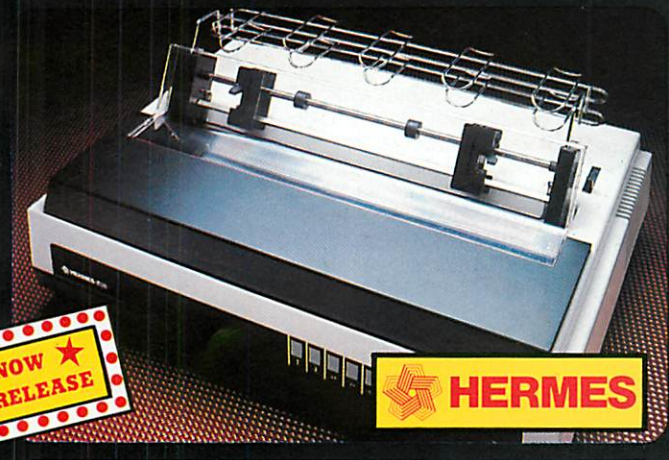

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● Circle No. 121

Better the devil you know

"CP/M is not dead, but revitalised and prepared to challenge MS-DOS, Unix or any other contender in the race to be the standard operating system for 16-bit processors."

Digital Research has been taking pains to reassure dealers that CP/M is not about to be pushed aside by more recent operating systems. Roger Cullis reports.

THIS WAS the message received by nearly 500 independent software vendors who crowded into the Cafe Royal on April 21 for an overview of the future as seen by Digital Research. With over 350,000 installations by over 500 different computer manufacturers, these were words of comfort to the software vendors who support applications programs written on CP/M. The last thing they want is to have to start again from scratch with each new upgrade in hardware technology

The presentation by Digital Research was the first opportunity to learn about the capabilties of a whole range of new software products. First, but not overshadowed by the rush of 16-bit systems, was the long-awaited CP/M 3.0, now renamed CP/M Plus. Externally it possesses many similarities to the tried and trusted CP/M 2.2, with which it is upwards compatible, and should present no problems to a user who is familiar with the existing system.

Internally, however, the changes are major and reflect current trends in operating-system technology. Directories are hashed, BDOS now executes least recently used buffering, drive capacity has been extended to 512Mbyte, maximum file size is 32Mbyte and new facilities include banked memory, extended line editing, password access and extended buffering.

To aid the user, a new Help command accesses a 76K data file which can be tailored to individual system requirements with detailed explanations of each CP/M command. It is now possible to use optional English words to make commands easier to use and remember. Time and date stamping will make for improved housekeeping. As an incentive to upgrade, CP/M Plus includes many transient programs which previously had to be purchased separately.

On the 16-bit front CP/M-86, which has already been around for some time, permits existing CP/M 2.2 programs to be run on an 8086 or 8088 processor based microcomputer such as the IBM PC or DEC Rainbow. Obviously, assembly language requires recoding, but high-level programs recompile with little modification.

To make software transportable, CP/M-86 uses 8086 registers corresponding to 8080 registers for system call and return parameters, loads programs into memory starting at 100H, and stores the default buffers and file control blocks in the base page of memory in exactly the same way as its eight-bit parent. The increased power provided by 16-bit processors means that a processor performing single tasks is under-utilised. Concurrent CP/M-86 allows the user to accomplish several tasks at the same time by creating a virtual console environment.

In a typical installation, several function keys on the console keyboard represent separate virtual consoles which can be switched in at any time. Virtual consoles operate in either dynamic or buffered modes. In the former a continuously updated screen image is stored in a buffer which can be switched in at any time in the manner of turning a chair from one physical console to another. In the buffered mode, output is stored in a disc file. Concurrent CP/M-86 supports multiple list devices each with up to 16 disc drives managing up to 512Mbtye. It can be used to monitor real-time events, and supports process synchronisation and communication by queues.

For those with Motorola 68000-based computers, CP/M-68K provides all the familiar features. Looking further into the future, CP/M will rapidly be made available on new processors as they are released, since the source code is now written in C and it is no longer necessary to start from scratch to implement a new system.

One area of microcomputing which has been crying out for standards is the field of graphics. Each new machine appearing in the market place has its own unique system which is not compatible with any of its competitors. In a bid to do for graphics what CP/M did for operating systems, Digital Research has now introduced CP/M Graphics, which is based on the ANSI and ISO standard graphical kernel system, GKS, designed to provide source-code portability.

A device-level interface addresses the ANSI virtual-device interface to provide object-code portability. A CP/M Graphics system is configured like a CP/M system, with GDOS and GIOS taking the place of BDOS and BIOS as the interface between a graphics utility running a graphics applications program and the graphics input and output hardware.

The graphics system extension, GSX, is loaded from disc prior to execution. It comprises the graphics device operating system, GDOS, which is device independent, the graphics input output system, GIOS, which is the device-dependent module that tailors GDOS to a specific device, and Gengraf, a utilty which configures a graphics application to run in the GSX environment.

As part of the CP/M Graphics package, Digital Research also provides GSS-Kernel, a subroutine library for graphics programmers and system builders which includes such things as two-dimensional primitives, hardware text, character and text-string attributes, line style, colour and pen control and a number of applications utilities. GSS-Plot contains high-level functions for business, engineering and scientific applications involving preparation of graphs and charts. GSS-4010 permits microcomputer users to emulate a Tektronix 4010, 4012 or 4014 to act as a Plot 10 compatible terminal. GSS-Graph enables a user without programming experience to produce presentation-quality graphs and charts; and GSS-Draw performs the same function with drawings such as organisation charts and slides.

After a review of its Language Division products CBasic, Pascal/MT+, Cis and Level II Cobol, Logo and C, Digital Research completed its new-product presentation by introducing two applications utilities. Display Manager creates, modifies and documents screen displays and stores them in an indexed file.

Each display is constructed from a blank screen by painting in the desired image using a powerful screen-oriented editor using standard alphanumeric characters as building blocks. Standard visual attributes found on a CRT terminal, including full or half intensity, inverted or flashing video and underlining, may be used. Access Manager is a versatile file-access method for CP/M systems.

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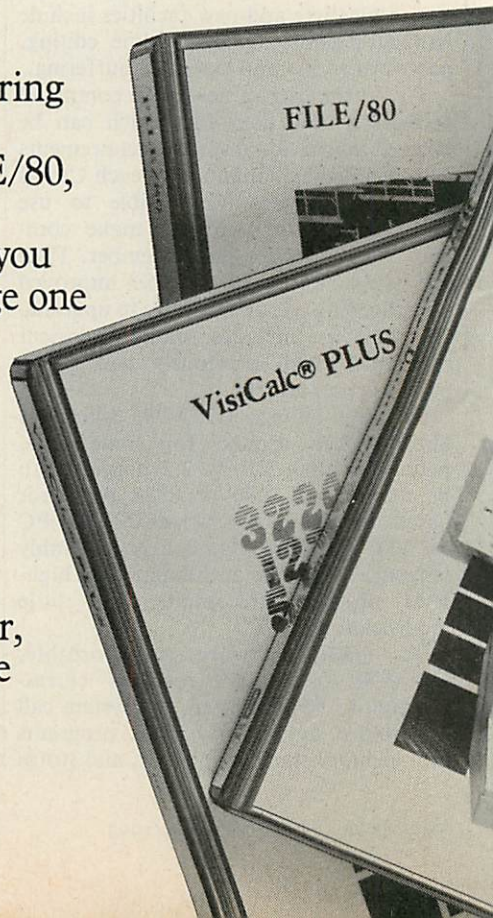

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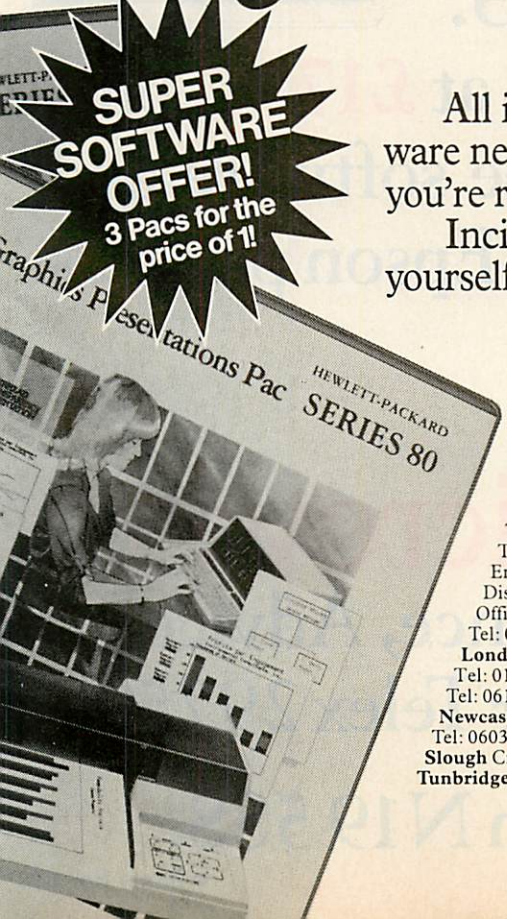

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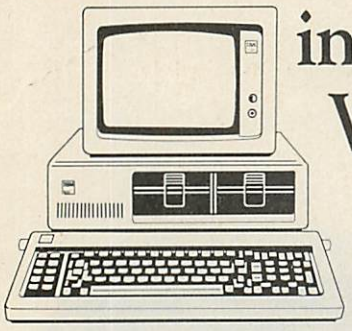

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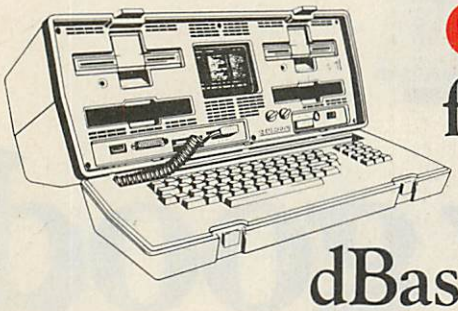

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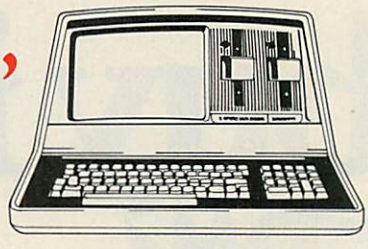

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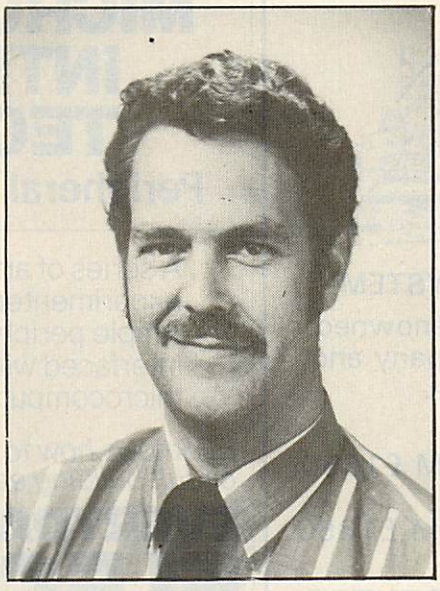

by Ray Coles

IT SEEMS not very long ago that you could have any microprocessor you liked as long as it was an Intel 4004 or 8008. At that time the designers and users of real computers had difficulty in suppressing a snigger, the public at large yawned — "Micro-what?" — and at CBM headquarters the "personal computer" still meant a four-function calculator. How things have changed!

The first microprocessor chips grew from calculator designs and used a technology called PMOS, which stands for p-channel, metal, oxide, silicon; the name describes the way the individual transistors on the chip are fabricated. In a nutshell, a piece of very pure silicon — a common element refined from sand — is doped with a small quantity of p-type impurity in which each atom has one less outer electron than the pure silicon.

Silicon itself is an insulator, but p-doped silicon has spaces or "holes" in its crystal structure which allow electrons to move about, and hence a current to flow. By doping a p "channel" into the silicon and covering it with a layer of insulating oxide and then a metal control gate, an MOS transistor is formed with a p-channel. Even in 1970 it was possible to put a couple of thousand devices on to a single chip, and with the aid of a metal interconnection pattern a functional circuit could be formed.

Trouble was hole mobility for the PMOS devices is low and the circuits require fairly high voltages to function properly. They are also slow in operation, and because of their p-type channel they appear to be "upside-down" when interfaced to external logic of the TTL type. What was needed was NMOS of course — everyone knew that — but unfortunately NMOS fabrication requires a dopant with one extra electron rather than one less and was too complex and expensive for use in large arrays at that time.

It is all history now, but in 1975 Intel cracked the problem and introduced the NMOS 8080, the first of the real microprocessors, and the microprocessor revolution was launched in earnest. Not that everything was perfect. The early NMOS technology used up quite a lot of silicon and still required some strange voltages to operate correctly, but equipment designers could see the potential and the race was on.

The constant procession of newer, bigger and faster devices since then is due almost entirely to improvements in the way that the individual NMOS transistors themselves are fabricated, and most particularly on how small they can be made.

All the major semiconductor firms have been on this particular development treadmill, and as they progress we reap the benefits with more powerful microprocessors and bigger, cheaper memories.

We have already heard about the PMOS 8008 and the NMOS 8080, but before long Intel had a new process, HMOS. It may look like something from a tax-return envelope — but actually stands for high performance NMOS. HMOS was first used on the 8085, successor to the 8080, but since then there have been new variations as Intel has refined its process to produce HMOS II, HMOS III and so on, with some of the latest devices having up to 1,000,000 transistors on one chip.

A prime example of what can now be achieved with HMOS is the new 27256 EPROM which is now available from Intel. This single device in a standard 28-pin package can store no less than 32K or software — enough space for VisiCalc, a word-processing package and a game or two, with room to spare.

Application software still has to come from disc or tape at present, because it has been too expensive to use the more convenient ROM method. Before long, and thanks to HMOS, we can expect our new personal computer to offer us things like CP/M, VisiCalc and WordStar at the press of a button. It will not be expensive because the special HMOS-E process which Intel has used allows all 262 144-bit cells to be put on to a chip only 4.29mm square — smaller than the first EPROM which only stored 256 bytes.

To achieve this kind of density Intel had to get the dimensions of the individual transistors down into the region of 1 micron or 1/1,000 of a millimetre. With that sort of geometry the traditional 21V EPROM programming voltage is a bit like the national grid. To compensate, Intel has reduced the programming voltage to 13V but have retained the 5V standard operating supply because it makes the EPROM faster. As with all EPROMs, the contents of the 27256 can be erased by the application of high-intensity short-wave ultraviolet light ready for reprogramming with new software to find the answer to Life, the Universe, and everything!

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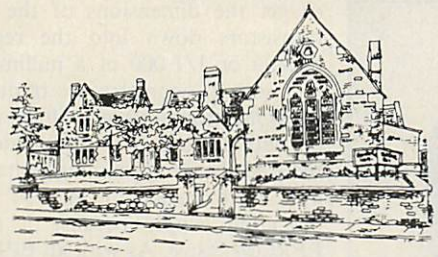

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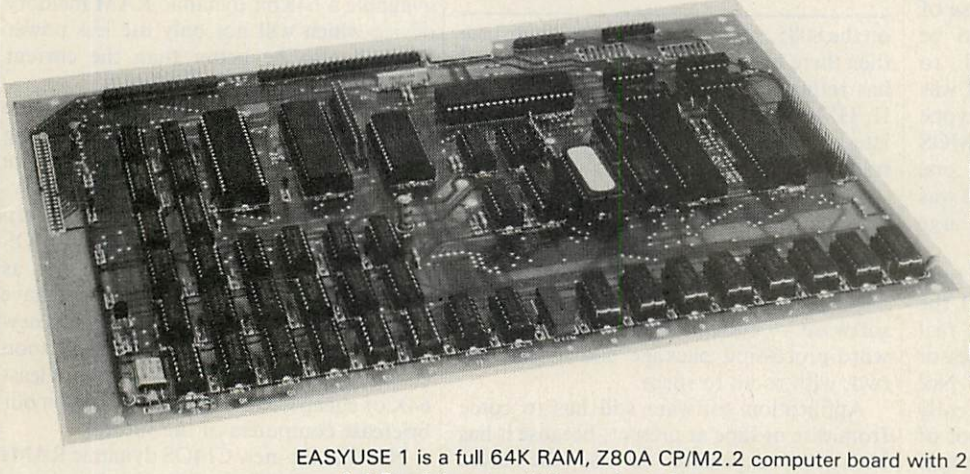

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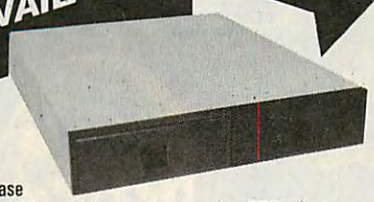

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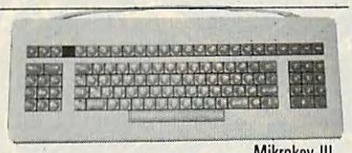

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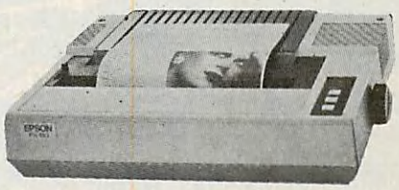

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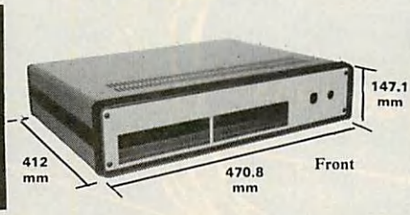

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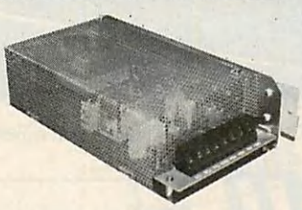

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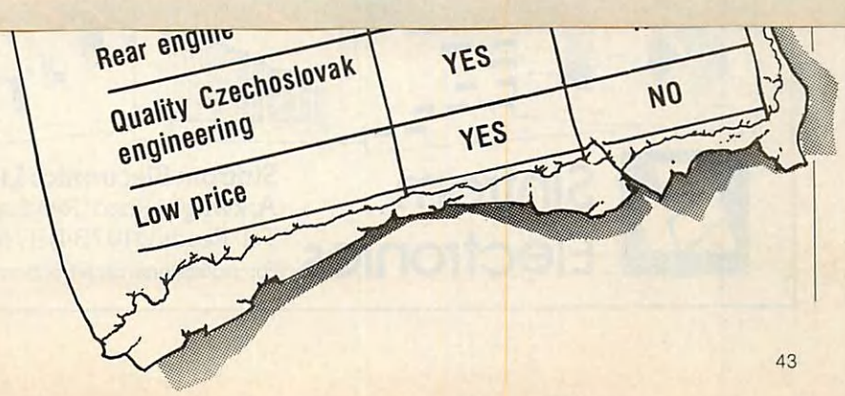
simple as possible. To that end it uses keywords on individual keys. Yet despite what others might say, I believe the use of the keyboard is over-complex. In terms of ease of use, the Spectrum is an advance over the ZX-81 because the keyboard is more positive and more than one statement is allowed on a line. Unfortunately the Spectrum is more difficult to use because the keys have far too many functions.

In terms of loading and saving



Random access

(continued from previous page)

BBC Micro than on the other two machines. The Spectrum is dominated by its version of Basic to such an extent that once the ability to use keywords is taken away, as in Forth, the drawbacks of the keyboard become more evident.

The question of other languages brings us to the next criterion, that of co-ordination, which seems to be related to computation by what might be described as rules of operation. The Spectrum system consists of a computer, a cassette recorder, and a printer. Though other peripherals can be added, the Spectrum is not designed to be extended to anything vast. The Spectrum can be extended quie remarkably — as can the ZX-81 — but the extensions are produced by private firms and individuals, partly to compensate for the Spectrum's inherent drawbacks. Proper keyboards are produced, to counteract the one on the Spectrum, and firms offer many kinds of interfaces to allow the Spectrum to be linked to grown-up devices.

The Vic-20 is an example of the standard Commodore philosophy: it is designed to be extended in many ways. But the way to extend it is by use of peripherals manufactured solely by Commodore — though, again, other firms also produce peripherals. The Spectrum can use any type of cassette recorder, but the Vic-20 has a special Commodore cassette recorder, and it is difficult to modify the interface to use normal recorders. However, the Spectrum has to use a special printer. The Vic-20 will take an ordinary printer, given a few adjustments, but Commodore likes you to buy its own model.

Manufacturer-friendly

The restrictions on the co-ordination of the system for the Spectrum and the Vic is partly due to the emphasis on user-friendliness at the communication stage. To keep your system user-friendly the manufacturer makes it possible for everything to be purchased from one source. It is not only user-friendly but also manufacturer-friendly. For the BBC Micro communication is not paramount, and the emphasis is towards computation and co-ordination. The BBC Micro is slowly beginning to be extended in many ways which are beyond the scope of the Spectrum or the Vic-20. For this reason the BBC Micro, like the Apple II, promises to be around for a long time, especially when the problems with the Tube are sorted out.

The lifespan of the Spectrum is not going to be as long as more co-ordinated computers. And the same is going to be ture — is already true? — for the Vic-20. Both the Spectrum and the Vic-20 are so user-friendly that hundreds of thousands have been sold. But in the long run, will they be gauged as successes in anything other than a commercial sense?

So far we have seen the importance of the design philosophy in setting the computer in context. Co-ordination is related to constitution by values implicit in the philosophy.

Both the Vic-20 and the Spectrum were designed as cheap colour computers with high profit margins. As the Spectrum came later it had to undercut the Vic-20, and did so by having a dummy keyboard and being less flexible. That the Vic-20 had a high profit margin was indicated by the drop in price when the Spectrum eventually appeared. High profit margins are the norm: the ZX-81's price dropped by 43 percent.

The Vic-20 and Spectrum can be used for applications other than home computing. But ultimately it might be cheaper, quicker and more reliable to go for a system designed to cope with more complex applications.

For the BBC Micro the philosophy of sophistication was paramount: the machine was meant to be flexible, to be extensible, to be able to cope in many different situations. For the BBC Micro the constitution was paramount, whereas for the other two communication was paramount.

When evaluating computers the criteria should not be simply numerical — "What is the resolution?" — but also qualitative, the hows and the whys. There are "horses for courses" and I hope to have clarified the course in which you are interested.

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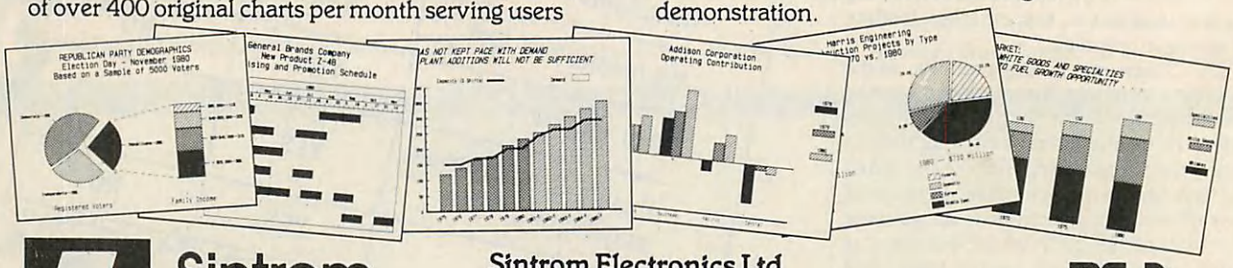

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Silicon futures

IT SEEMS not very long ago that you could have any microprocessor you liked as long as it was an Intel 4004 or 8008. At that time the designers and users of real computers had difficulty in suppressing a snigger, the public at large yawned — "Micro-what?" — and at CBM headquarters the "personal computer" still meant a four-function calculator. How things have changed!

The first microprocessor chips grew from calculator designs and used a technology called PMOS, which stands for p-channel, metal, oxide, silicon; the name describes the way the individual transistors on the chip are fabricated. In a nutshell, a piece of very pure silicon — a common element refined from sand — is doped with a small quantity of p-type impurity in which each atom has one less outer electron than the pure silicon.

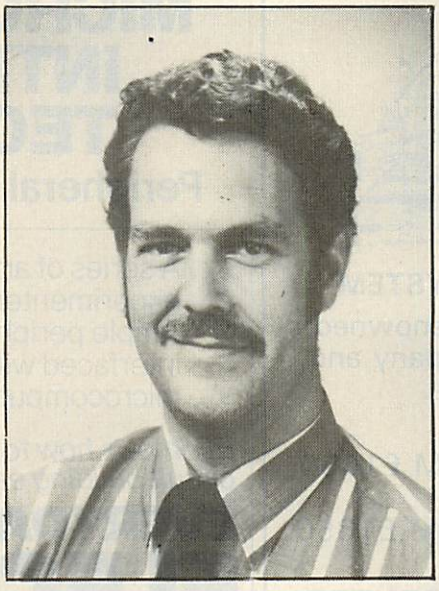
Silicon itself is an insulator, but p-doped silicon has spaces or "holes" in its crystal structure which allow electrons to move about, and hence a current to flow. By doping a p "channel" into the silicon and covering it with a layer of insulating oxide and then a metal control gate, an MOS transistor is formed with a p-channel. Even in 1970 it was possible to put a couple of thousand devices on to a single chip, and with the aid of a metal interconnection pattern a functional circuit could be formed.

Trouble was hole mobility for the PMOS devices is low and the circuits require fairly high voltages to function properly. They are also slow in operation, and because of their p-type channel they appear to be "upside-down" when interfaced to external logic of the TTL type. What was needed was NMOS of course — everyone knew that — but unfortunately NMOS fabrication requires a dopant with one extra electron rather than one less and was too complex and expensive for use in large arrays at that time.

It is all history now, but in 1975 Intel cracked the problem and introduced the NMOS 8080, the first of the real microprocessors, and the microprocessor revolution was launched in earnest. Not that everything was perfect. The early NMOS technology used up quite a lot of silicon and still required some strange voltages to operate correctly, but equipment designers could see the potential and the race was on.

The constant procession of newer, bigger and faster devices since then is due almost entirely to improvements in the way that the individual NMOS transistors themselves are fabricated, and most particularly on how small they can be made.

All the major semiconductor firms have



been on this particular development treadmill, and as they progress we reap the benefits with more powerful microprocessors and bigger, cheaper memories.

We have already heard about the PMOS 8008 and the NMOS 8080, but before long Intel had a new process, HMOS. It may look like something from a tax-return envelope — but actually stands for high performance NMOS. HMOS was first used

by Ray Coles

on the 8085, successor to the 8080, but since then there have been new variations as Intel has refined its process to produce HMOS II, HMOS III and so on, with some of the latest devices having up to 1,000,000 transistors on one chip.

A prime example of what can now be achieved with HMOS is the new 27256 EPROM which is now available from Intel. This single device in a standard 28-pin package can store no less than 32K or software — enough space for VisiCalc, a word-processing package and a game or two, with room to spare.

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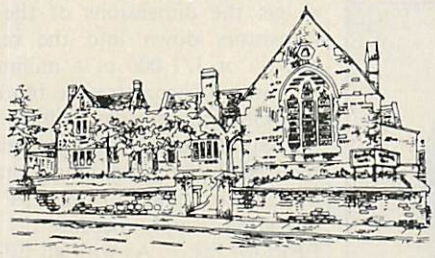

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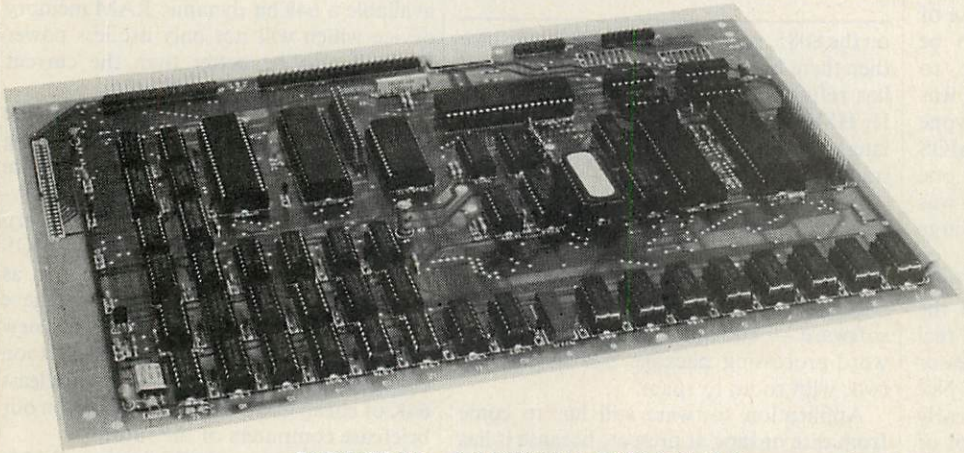

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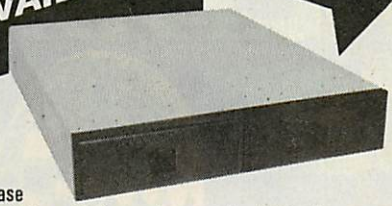

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⅔ height drives (57mm high) the case
also accommodates slim line ½ height drives (41mm high) — colour matches BBC micro

TWIN 40 track single sided (200K) cased with professional grade switch mode PSU . . . £360 + £10 P & P + VAT = £425.50
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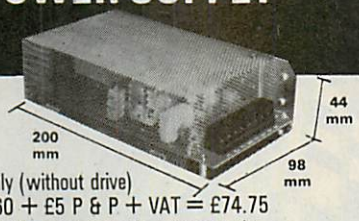

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(Measures W 300mm x D 350mm x H 57mm)
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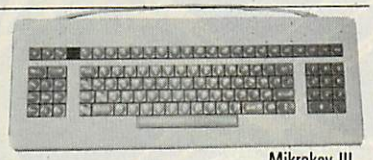

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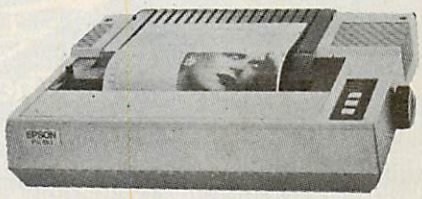

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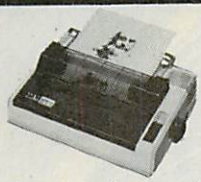

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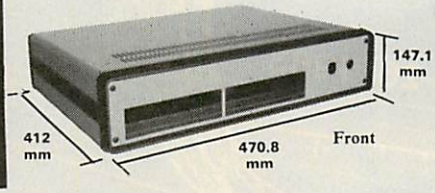

houses Micronix 80HD, ⅔ height 5¼" floppies (½ height floppies optional), a switch mode power supply for the complete system. The panels have cutouts for floppies, connectors and a fan (as illustrated). Thoughtfully constructed for easy accessibility. Cover and base grey/beige. Frame dark brown.
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Back

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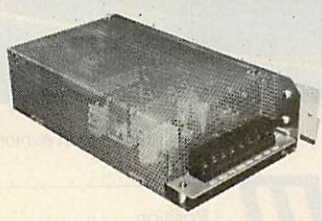

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CO4 comparisons

Boris Allan tries to help you choose your micro with his CO4 criteria.

WITH SO MANY computers now appearing in the market place it is clear there is a need for some way to compare them. But rather than concentrating on items such as colour, high-resolution graphics, the type of keyboard and similar, I will concentrate on the purpose served by the machine. This does not mean that its features are not important, but such comparisons are notoriously suspect. I am thinking of the tables that some manufacturers produce to justify their product's excellence: the more specific the comparison, the simpler it is to prove your machine is best on your chosen criteria.

If you concentrate on the function of the machine and look at the machine as part of a system, you can see that there are certain basic reqirements that need to be satisfied by any system. The basic requirements of a computer system are the CO4 criteria:

- Communication — How does the computer solve the problem of communicating with the user?
- Computation — How does the computer produce the desired results?
- Co-ordination — How are the different aspects of the computer system interrelated?
- Constitution — What is the design philosophy behind the computer?

The first three criteria are "hows" and might possibly be seen as equivalent, in some senses, to the colour, graphics and keyboard form of discrimination. The added criterion is a "Why" — there is this computer, why is it like this? To illustrate the way these criteria may be used I will apply them to three rather different computers: the ZX Spectrum, the Vic-20, and the BBC Microcomputer.

To use a computer one needs to communicate with it. Some computers are what is called user-friendly, but a user-friendly computer is not always a powerful or flexible one. When we use this criterion our attention is directed towards the way the user interacts in, say, entering, loading or saving a program.

The Spectrum is designed to make entering a program from the keyboard as simple as possible. To that end it uses keywords on individual keys. Yet despite what others might say, I believe the use of the keyboard is over-complex. In terms of ease of use, the Spectrum is an advance over the ZX-81 because the keyboard is more positive and more than one statement is allowed on a line. Unfortunately the Spectrum is more difficult to use because the keys have far too many functions.

In terms of loading and saving programs the Spectrum is about as good as most cassette-based systems. The vast improvement over the ZX-81 was probably due to the extreme user-unfriendliness of the ZX-81's cassette system.

The Vic-20 was also designed to be user-friendly, but the definition of user-friendliness was different. The Vic-20 was designed to be a proper computer with a proper keyboard, compatible in many respects with a very successful series of computers, the Commodore Pets. Whereas Sinclair tried to make the language user-friendly, Commodore tried to make the box easy to use and the language familiar.

The Sinclair approach, using keywords, led to complex use of the keyboard. The Commodore approach of slightly modifying Pet Basic led to the language not being flexible in the use of graphics.

Though the BBC Micro is fairly friendly, it was intended to be a serious machine for serious and non-serious users. Friendliness was not high in the scale of priorities. It takes more effort to learn to use the BBC Micro but it can do a lot more.

For the BBC Micro communication was less important than computation, that is the programming language. It is very difficult to have a user-friendly language that is also computationally powerful. For example, it is difficult to add new commands to Sinclair Basic because of the use of keywords, whereas it is comparatively easy to add new commands to the Vic-20 and BBC Basics.

Each Basic has its own problems — the VDU command on the BBC, the lack of high-resolution graphics on the Vic-20, and the contamination of Inks in high-resolution on the Spectrum — but in the case of the Spectrum and possibly the Vic-20, communication was more important than computation. The relationship between computation and communication can be seen to set the style of the computer system as a whole.

There is far more to computing than just Basic, witness the increasing number of machine-code games being produced. But the Spectrum and Vic-20 are very much Basic-dominated machines. Neither adapt easily to use other languages and machine code, especially on the Spectrum, can be tedious to write, though not impossible.

The ability to use machine code is built into BBC Basic. Languages other than Basic are simpler to implement on the

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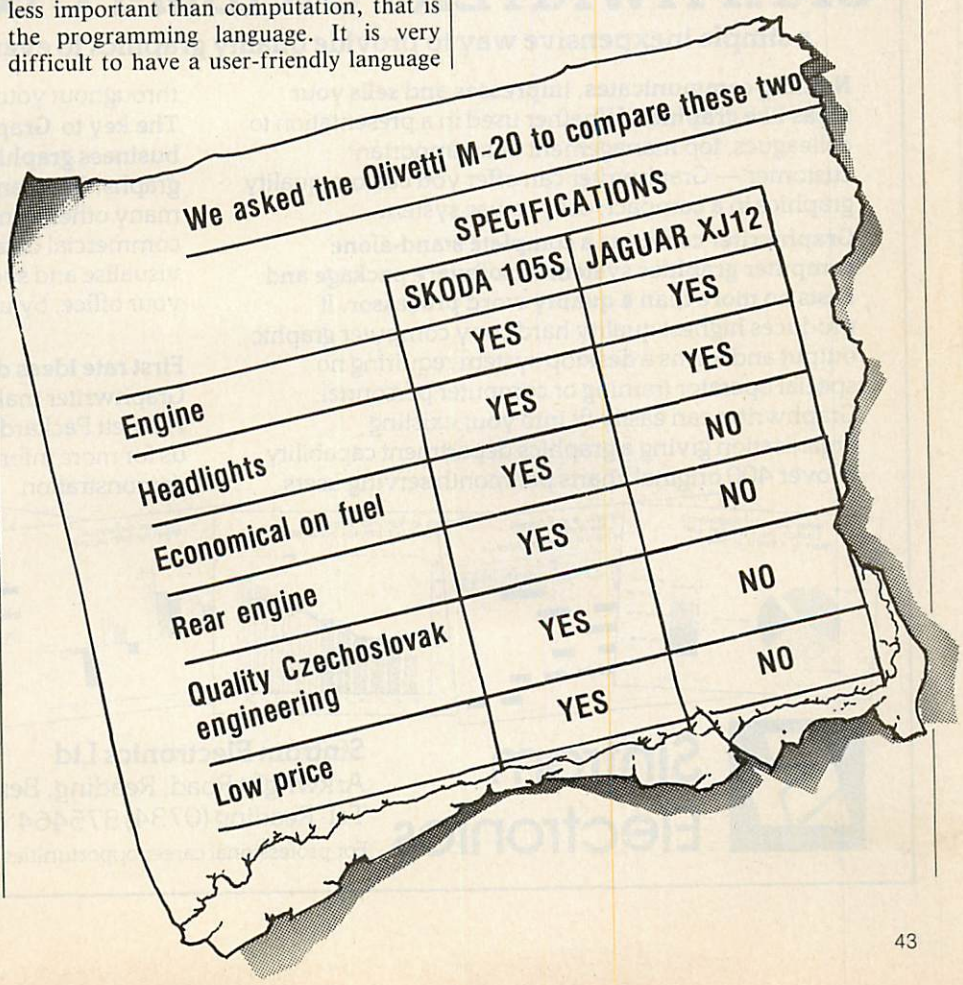

(continued from previous page)
BBC Micro than on the other two machines. The Spectrum is dominated by its version of Basic to such an extent that once the ability to use keywords is taken away, as in Forth, the drawbacks of the keyboard become more evident.

The question of other languages brings us to the next criterion, that of co-ordination, which seems to be related to computation by what might be described as rules of operation. The Spectrum system consists of a computer, a cassette recorder, and a printer. Though other peripherals can be added, the Spectrum is not designed to be extended to anything vast. The Spectrum can be extended quie remarkably — as can the ZX-81 — but the extensions are produced by private firms and individuals, partly to compensate for the Spectrum's inherent drawbacks. Proper keyboards are produced, to counteract the one on the Spectrum, and firms offer many kinds of interfaces to allow the Spectrum to be linked to grown-up devices.

The Vic-20 is an example of the standard Commodore philosophy: it is designed to be extended in many ways. But the way to extend it is by use of peripherals manufactured solely by Commodore — though, again, other firms also produce peripherals. The Spectrum can use any type of cassette recorder, but the Vic-20 has a special Commodore cassette recorder, and it is difficult to modify the interface to use normal recorders. However, the Spectrum has to use a special printer. The Vic-20 will take an ordinary printer, given a few adjustments, but Commodore likes you to buy its own model.

Manufacturer-friendly

The restrictions on the co-ordination of the system for the Spectrum and the Vic is partly due to the emphasis on user-friendliness at the communication stage. To keep your system user-friendly the manufacturer makes it possible for everything to be purchased from one source. It is not only user-friendly but also manufacturer-friendly. For the BBC Micro communication is not paramount, and the emphasis is towards computation and co-ordination. The BBC Micro is slowly beginning to be extended in many ways which are beyond the scope of the Spectrum or the Vic-20. For this reason the BBC Micro, like the Apple II, promises to be around for a long time, especially when the problems with the Tube are sorted out.

The lifespan of the Spectrum is not going to be as long as more co-ordinated computers. And the same is going to be ture — is already true? — for the Vic-20. Both the Spectrum and the Vic-20 are so user-friendly that hundreds of thousands have been sold. But in the long run, will they be gauged as successes in anything other than a commercial sense?

So far we have seen the importance of the design philosophy in setting the computer in context. Co-ordination is related to constitution by values implicit in the philosophy.

Both the Vic-20 and the Spectrum were designed as cheap colour computers with high profit margins. As the Spectrum came later it had to undercut the Vic-20, and did so by having a dummy keyboard and being less flexible. That the Vic-20 had a high profit margin was indicated by the drop in price when the Spectrum eventually appeared. High profit margins are the norm: the ZX-81's price dropped by 43 percent.

The Vic-20 and Spectrum can be used for applications other than home computing. But ultimately it might be cheaper, quicker and more reliable to go for a system designed to cope with more complex applications.

For the BBC Micro the philosophy of sophistication was paramount: the machine was meant to be flexible, to be extensible, to be able to cope in many different situations. For the BBC Micro the constitution was paramount, whereas for the other two communication was paramount.

When evaluating computers the criteria should not be simply numerical — "What is the resolution?" — but also qualitative, the hows and the whys. There are "horses for courses" and I hope to have clarified the course in which you are interested.

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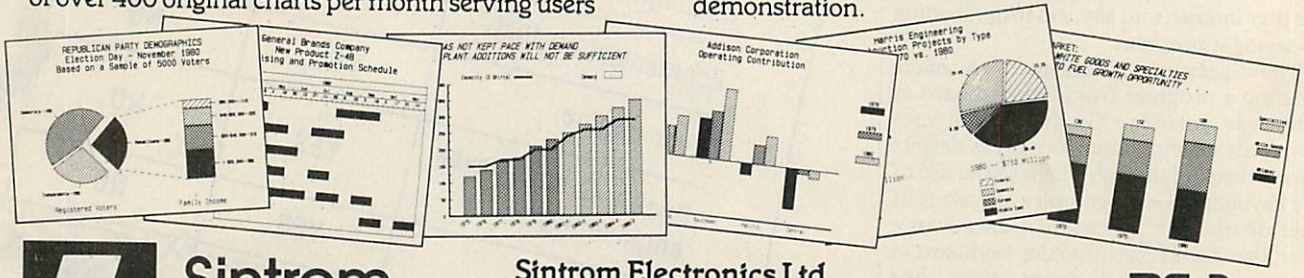

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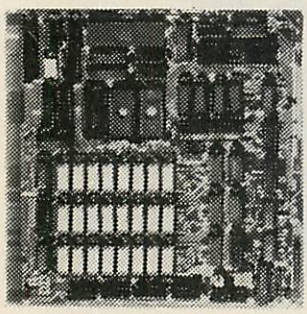

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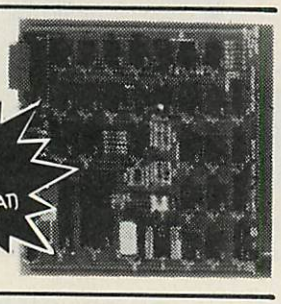

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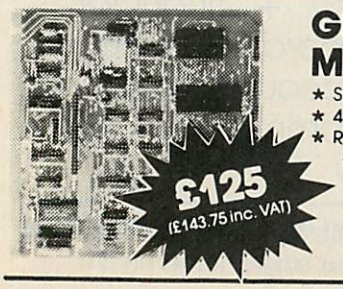

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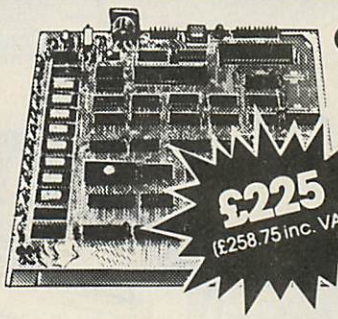

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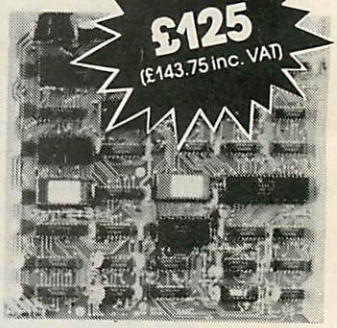

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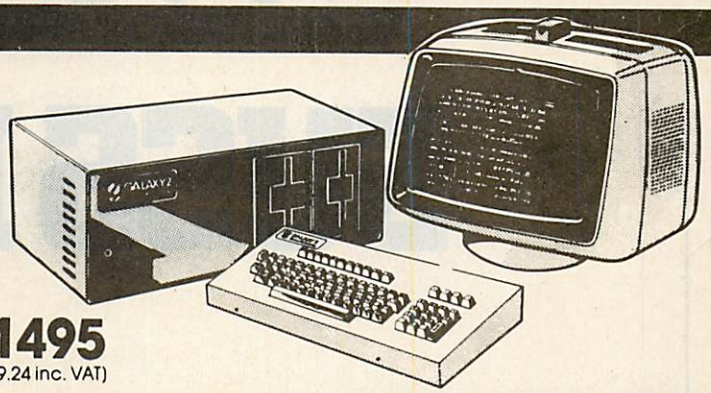

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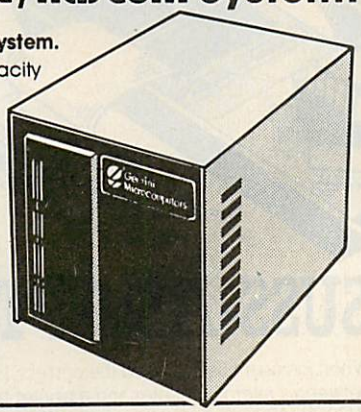

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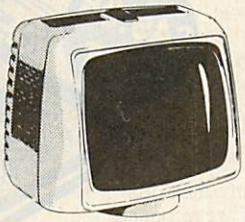

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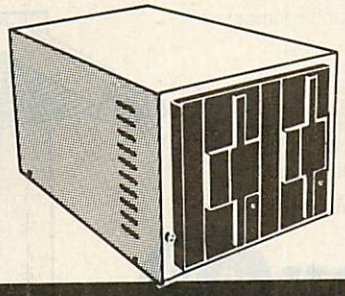
An optional alternative to CP/M is available for Nascom owners wishing to support existing software.
Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.



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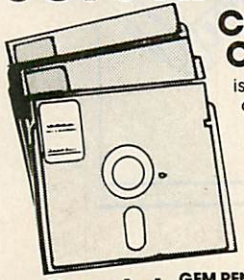

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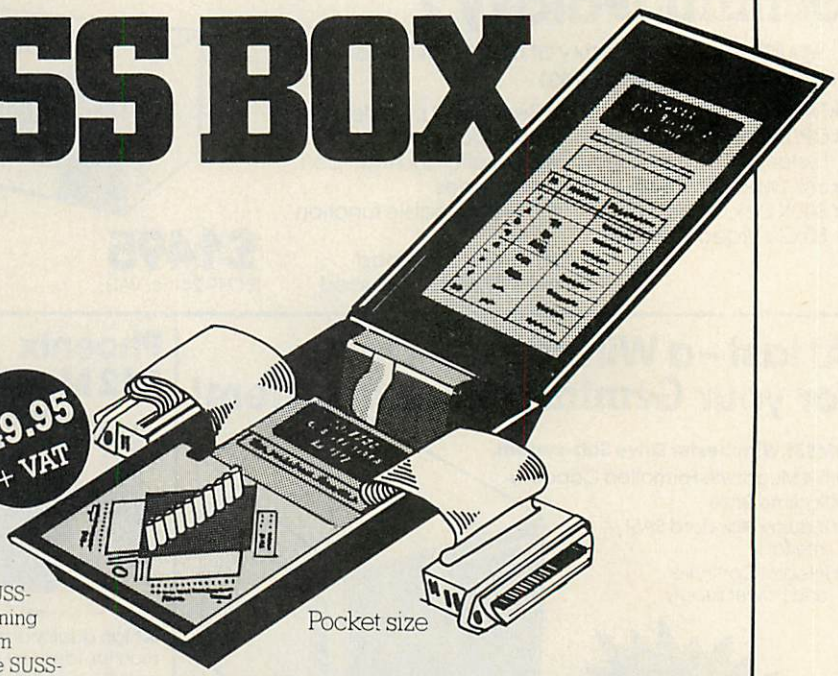

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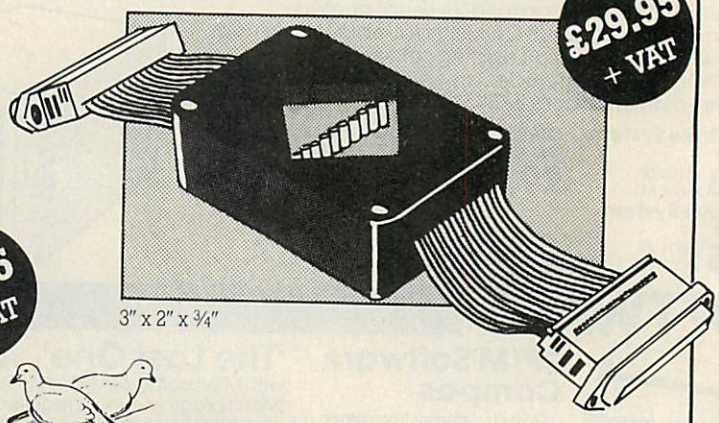

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Practical Computing's £500 birthday competition

Write a news report on a new micro launched in July 1988, and you could win £500-worth of Commodore equipment of your choice

WHEN THIS MAGAZINE started, five years ago, it was not uncommon for enthusiasts to put a micro together for themselves. The motherboard, video board, memory, keyboard, Basic, etc. might all be bought separately and at enormous expense. People often built their own micros from kits to save money. As for software . . . What software?

The Commodore Pet was a significant introduction into this market because it made microcomputing accessible to everyone. It came as an integrated package, including Basic, keyboard, cassette deck and screen. All you had to do was plug it in and go.

Last but not least, it had a friendly, approachable name. "Pet" was supposed to stand for Personal Electronic Transactor, or some such rubbish, but a household Pet it became.

Commodore was not the only company to make an impact in those early days — the Apple, Tandy TRS-80 and Exidy Sorcerer models were also attractive, as was the British Research Machines 380-Z — but the "one box" principle was both unique and important.

Five years later, the basic microcomputer has changed surprisingly little. The Apple IIe and TRS-80 models soldier on in fundamentally the same form, and the Commodore 8096, for all its 96K memory, is instantly recognisable to anyone who saw the original Pet.

At the same time new ranges have grown up on either side of the original all-purpose line. At lower prices there is now a huge mass of home computers with colour and sound facilities. At higher prices there are hundreds of business machines provided with floppies and hard discs, the IBM PC, Sirius 1 and DEC Rainbow among them. The all-purpose micro continues with machines that include colour and sound, but also proper keyboards and business software and facilities, as exemplified by the Acorn/BBC Model B, Atari 800 and Commodore 64.

In addition, a new type of computer is becoming popular, the portables. They range from the pocketable micro with a single-line display such as the Sharp PC-1500 through phone-book sized computers such as the Epson HX-20 to mains-powered transportable machines like the Osborne and Dynalogic Hyperion.

The earliest family Pet.

Rather than slowing down, the pace of new developments is hotting up. More new micros, and more different new micros, are coming out than ever before. Five years ago, who outside the pages of science fiction believed the Gavilan portable micro detailed on page 15 of this issue was possible, let alone likely to appear at an affordable price?

Our question is: *What will the new micro of 1988 be like?* Send us your answer in the form of a short news report about one new microcomputer. Make it suitable for publication in the news pages of *Practical Computing*. You can include sketches or diagrams and a specification sheet, but the number of words must be less then 1,500. The deadline for entries is August 1, 1983.

The entries will be read by the staff of *Practical Computing*, and the winner will be selected by the Editor. The prize: £500-worth of Commodore products of your choice.

Practical Computing is not the sort of publication that holds a competition every month or even every year, so we hope you will get out your word processor, typewriter or even a primitive manual writing implement, and have a go.

A selection of the best entries will be published later this year, then held on file for our 10th anniversary issue in July 1988. The comparison then should be fascinating.

Rules

1. Entries must consist of a description of one microcomputer launched in 1988, in the form of a news report not longer then 1,500 words.
2. Entries must be marked COMPETITION on the envelope and arrive by August 1, 1983. The address is : Birthday Competition, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
3. The Competition is not open to employees of Business Press International Ltd, or Commodore (U.K.) Ltd or members of their families.
4. The Editor of *Practical Computing* is the sole judge in the competition, and his decision will be final. No correspondence can be entered into.
5. The result of the competition will be announced in the first available issue of *Practical Computing*. The winning entry will be reproduced, and other entries may be reproduced without payment. The author of the winning entry will be able to select £500-worth of Commodore equipment of his or her choice by arrangement with Commodore (U.K.) Ltd.

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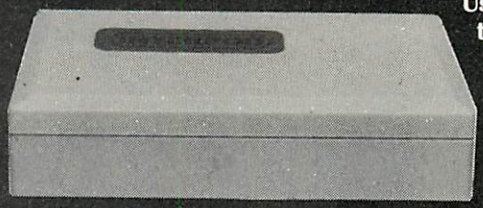

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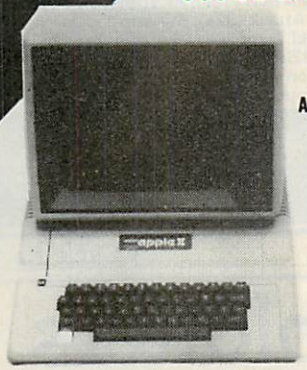

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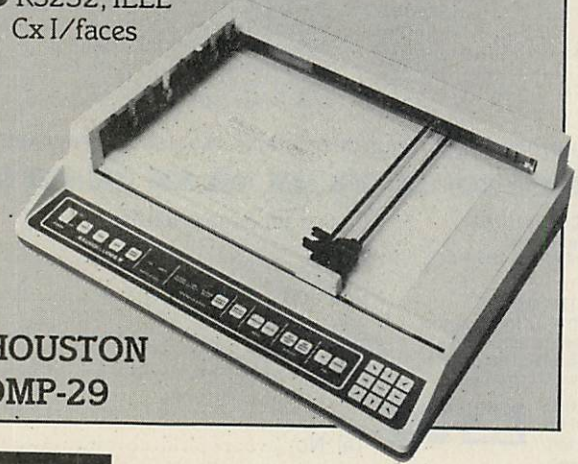

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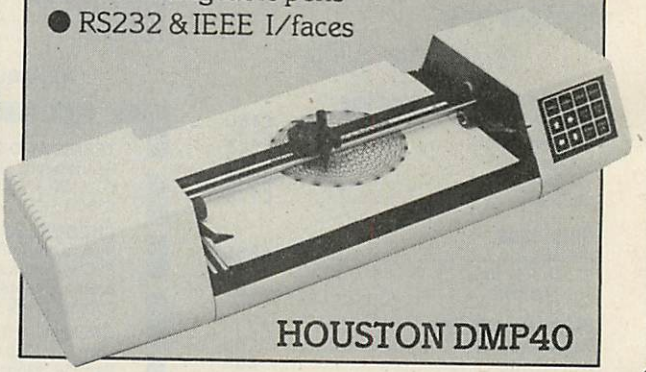

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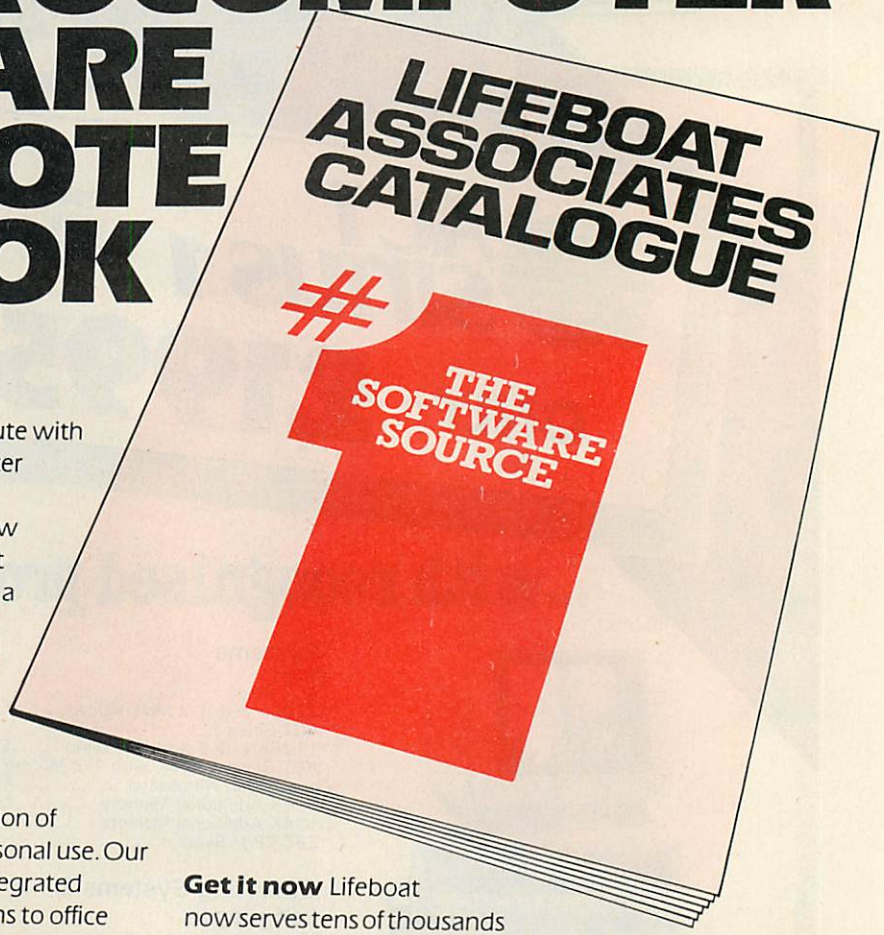

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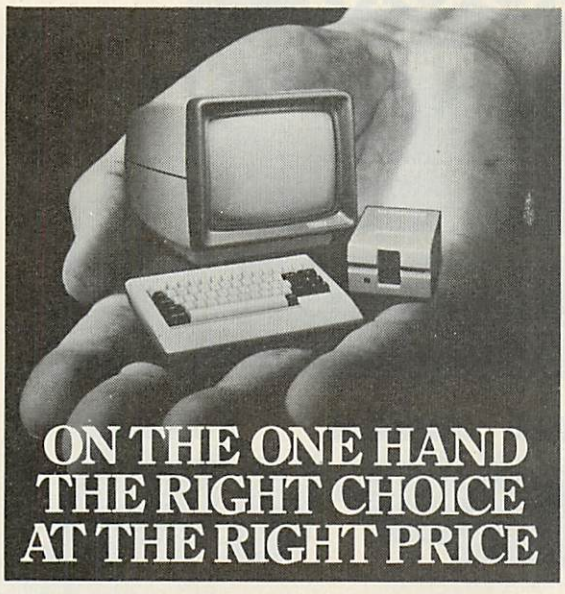

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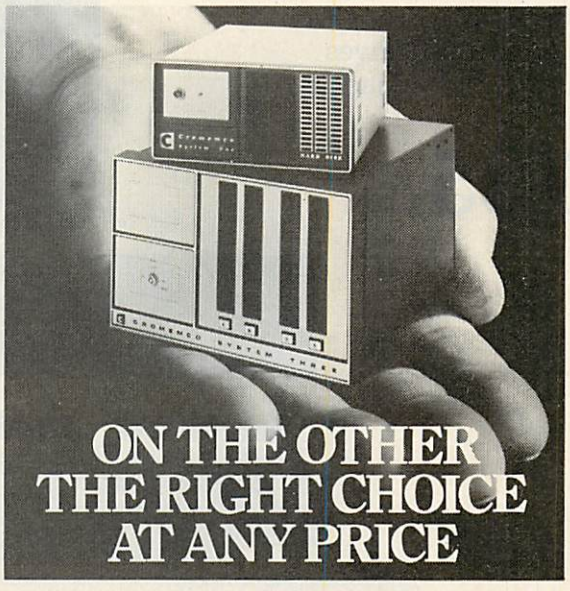

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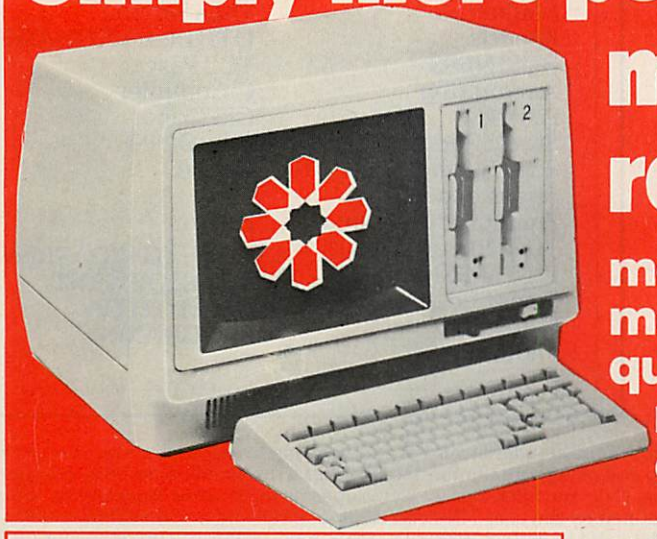

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S16-Bit Mega Micro

TECHNICAL DATA

Processor: 16-Bit 8086, cycle time 215 Nano Seconds. **Architecture:** DMA Bus based, true 16-Bit. **Speed:** DMA @ 6MB/sec; Disc transfer @ 3MB/sec. **Memory (RAM):** 128KB standard, expandable to 640KB. **Screen:** High resolution green; anti-glare optical filter. Colourgraphics optional extra. **Discs:** Two 8" DS/DD giving 2.36 MB usable. IBM compatible. **Interfaces:** 2 RS 232 communications interfaces. Plus: Centronic printer interface. **Operating Systems:** MS-DOS CP/M-86. 8-bit software emulator. **Languages for 16-bit:** Basic, Cobol, Pascal, Fortran, PL/1, BCPL compilers and interpreters available. **Customising:** with logo, namestyle and house colours, can be arranged. **"So simple to operate" – and don't forget, the S16-bit Mega Micro is built to military standards with laboratory-level quality control for complete dependability.**

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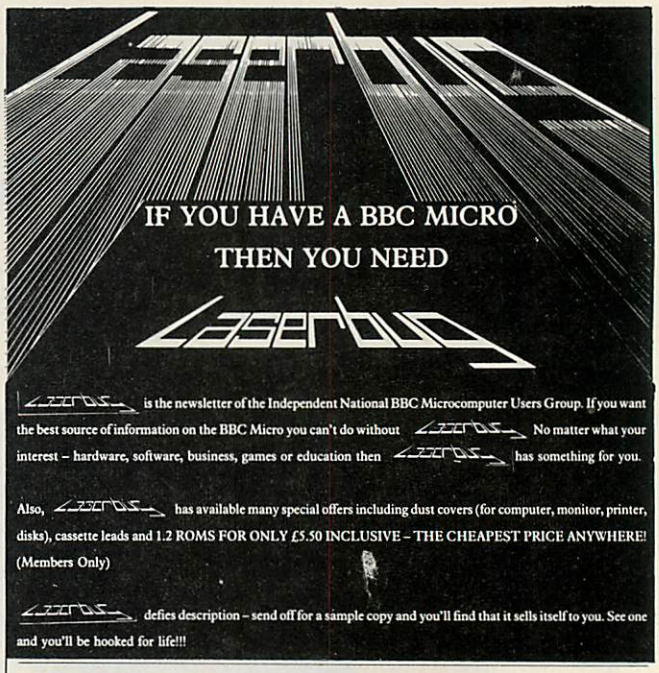

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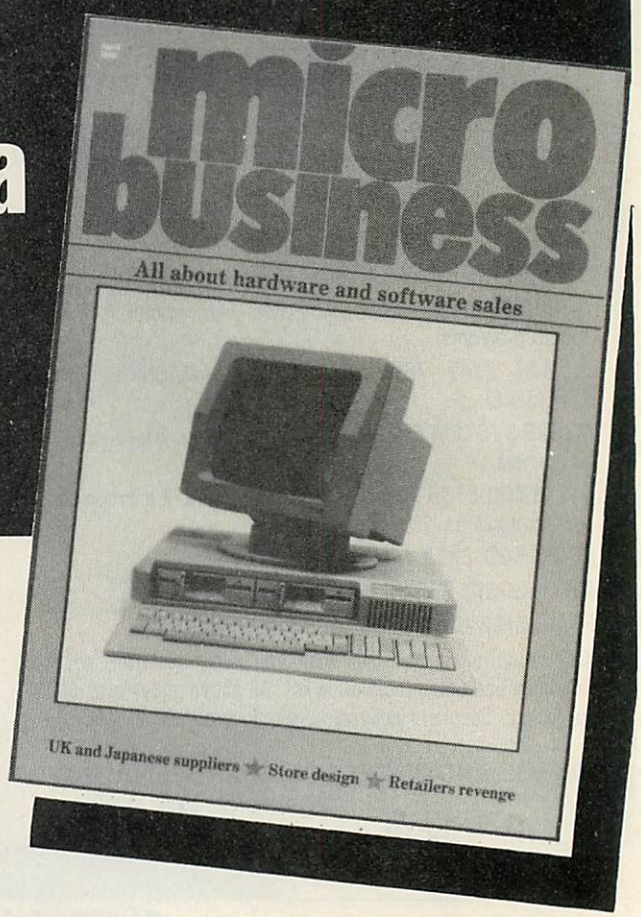

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Although the NewBrain is conceived as a total system, the unexpanded Processor itself has a great deal to offer. It is available in two forms: Model AD, shown below, with a built-in line display; and Model A, without the line display. Both models can operate with a monitor or a television set.

MEMORY

- 24K bytes of ROM;
- 32K bytes of RAM, at least 28K of which is available to the user.

THE SCREEN DISPLAY

- 40 or 80 characters to the line – without affecting the 28K bytes of RAM at your disposal;
- 24 or 30 lines to the screen;
- well-formed characters, with true descenders;
- a full European character set;
- normal or reverse video, high resolution graphics on screen of controllable size, 256, 320, 512 or 640 horizontal resolution by 250 vertical lines;
- a facility to set up a "page" of up to 255 lines, with the screen acting as a "window" to display it;
- ability to maintain several such pages simultaneously, and to switch rapidly between them;
- text may be used on graphics screen as well as on parts of the video screen not used by graphics.

CHARACTER SET

- 512 characters, including the full ASCII set, all European accented characters, Greek and graphics symbols.

GRAPHICS

- 20 powerful graphics commands;
- all text characters usable on the graphics screen;
- variable-sized graphics screen, with the rest of the screen available for text – for versatility and to save memory.

SOFTWARE

Enhanced ANSI BASIC; screen editor (32 commands); mathematics package (10 significant figures); graphics commands.

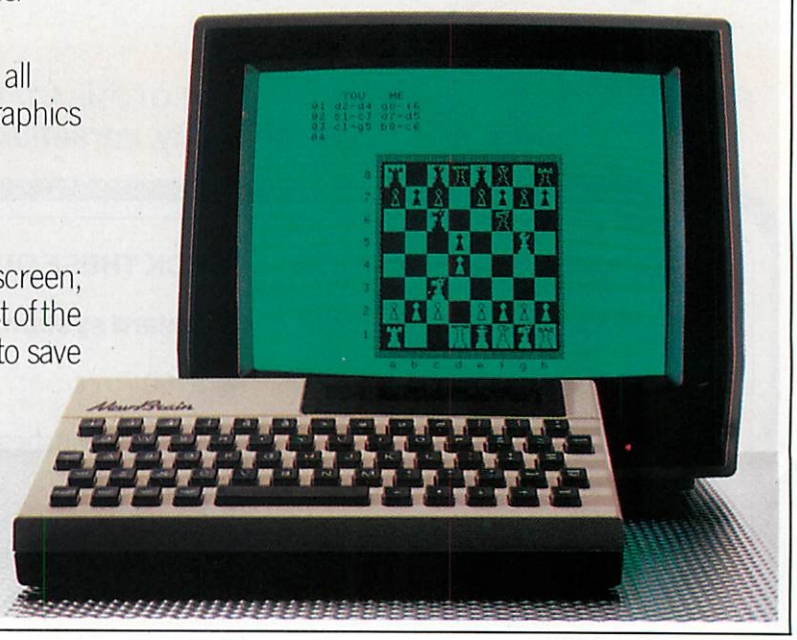
- a very friendly screen editor – a delight to use and readily adapted to text processing;
- arithmetic to 10 significant figures;
- very controllable output formatting of numbers – invaluable for accounting, statistics, and scientific applications;
- a powerful, much enhanced BASIC;
- a very flexible operating system, which allows any data stream to be opened to any device.

INTERFACES

- two tape cassette ports built into the processor unit;
- a built-in printer interface;
- a built-in communications interface (V24/RS232);
- a video monitor interface;
- a TV interface;
- an expansion interface for NewBrain system expansion modules.

KEYBOARD

- standard typewriter pitch, action, layout and size, with editing control and graphics keys.



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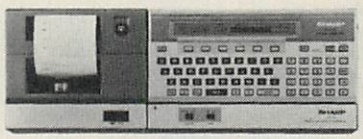

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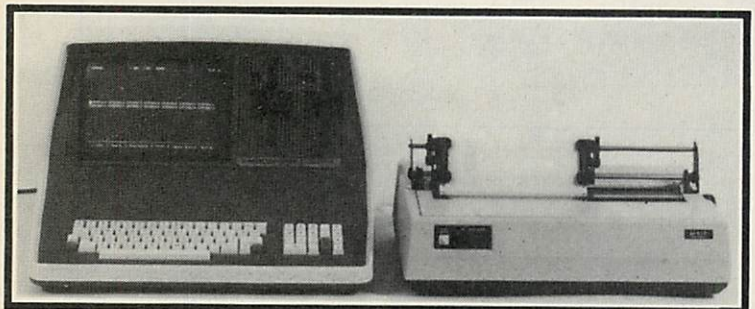

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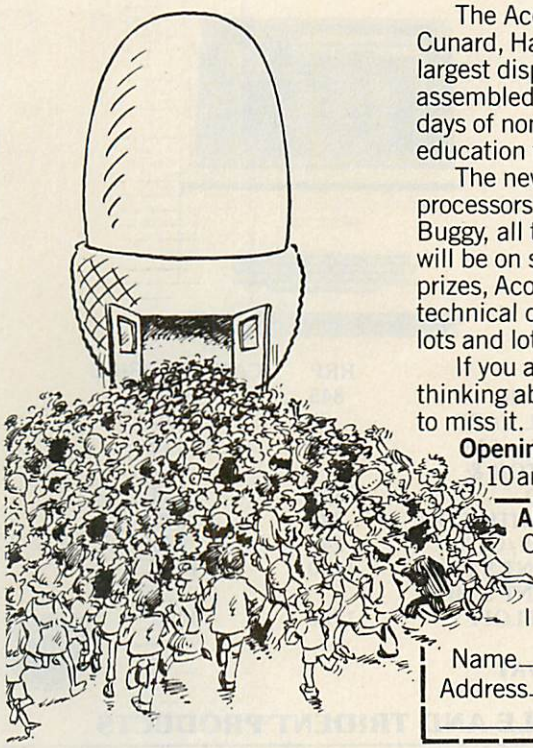

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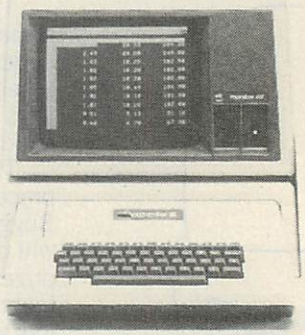

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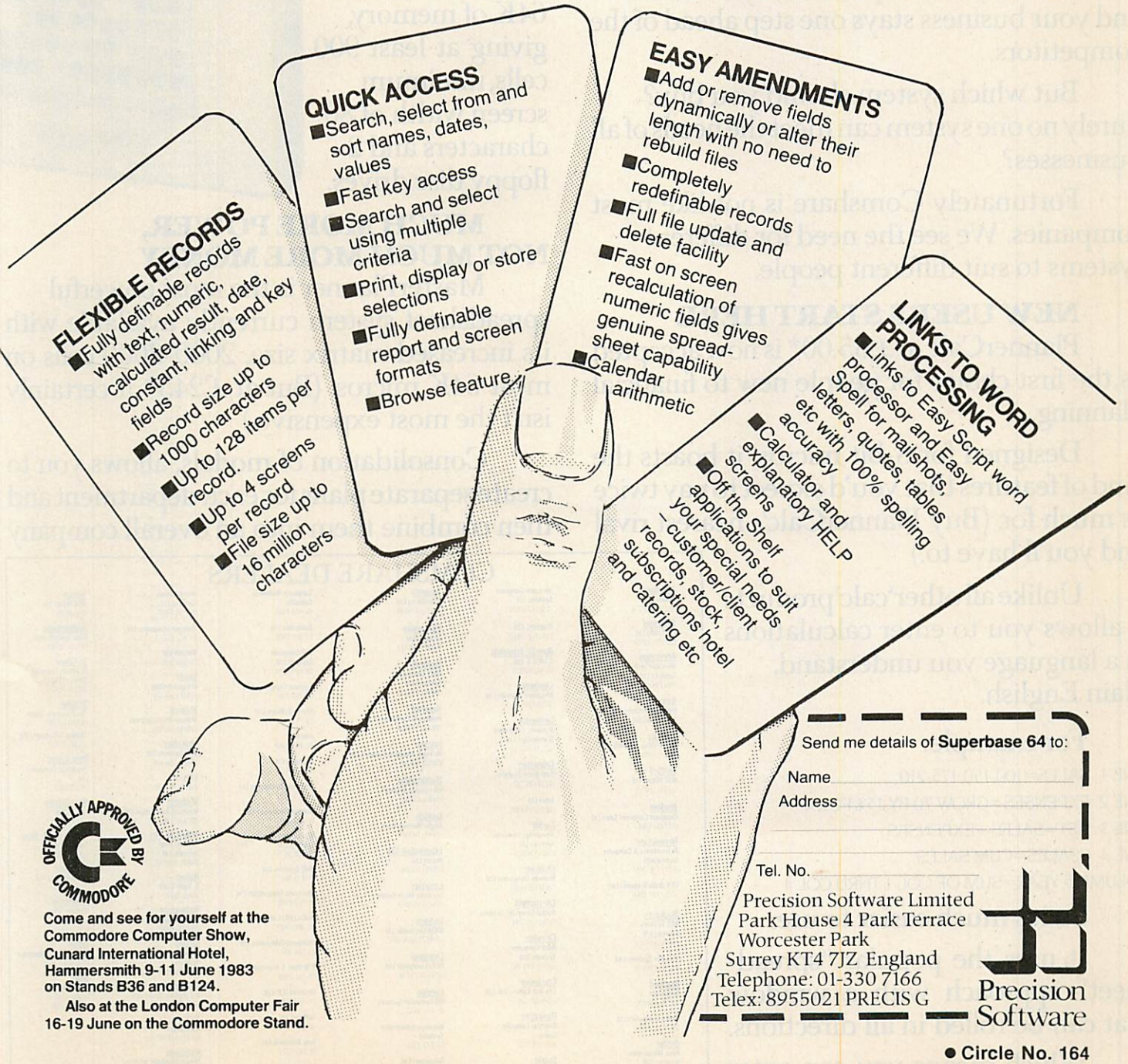
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■Search, select from and sort names, dates, values
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LINE 3 NET=SALES−EXPENSES
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So it's much easier to use.

It uses the popular "spreadsheet" approach with a window that can be rolled in all directions.

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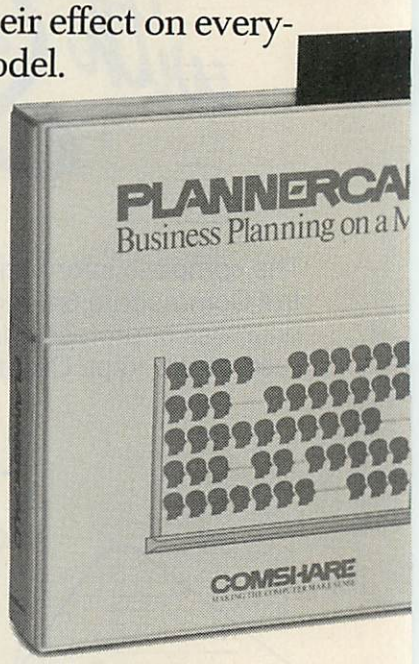

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It can store up to 25 standard reports to run when you need them. It's got full WHAT IF? analysis and direct editing of both spreadsheet and logic display.

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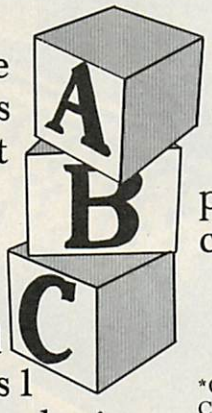
It works on exactly the same system as PlannerCalc and models written on PlannerCalc run without modification on MasterPlanner.



16 BIT VERSION

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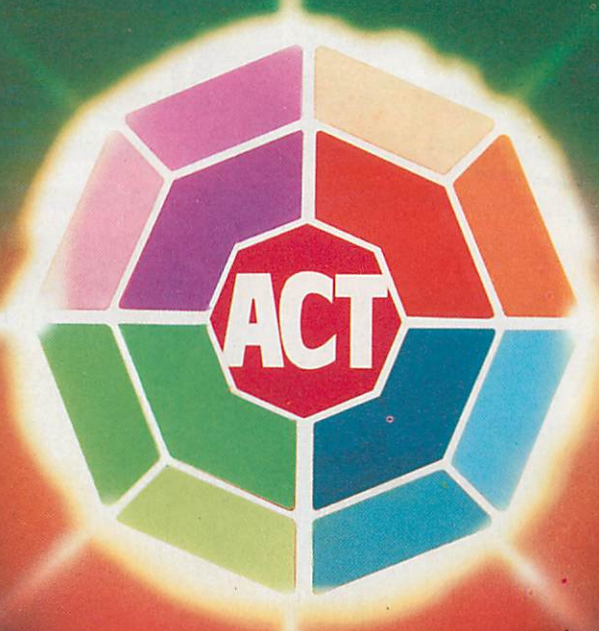

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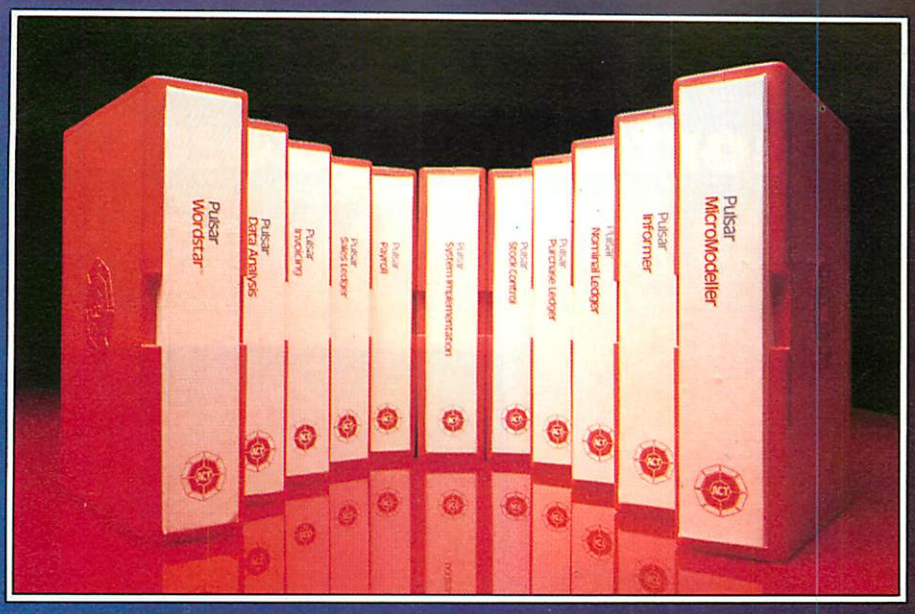

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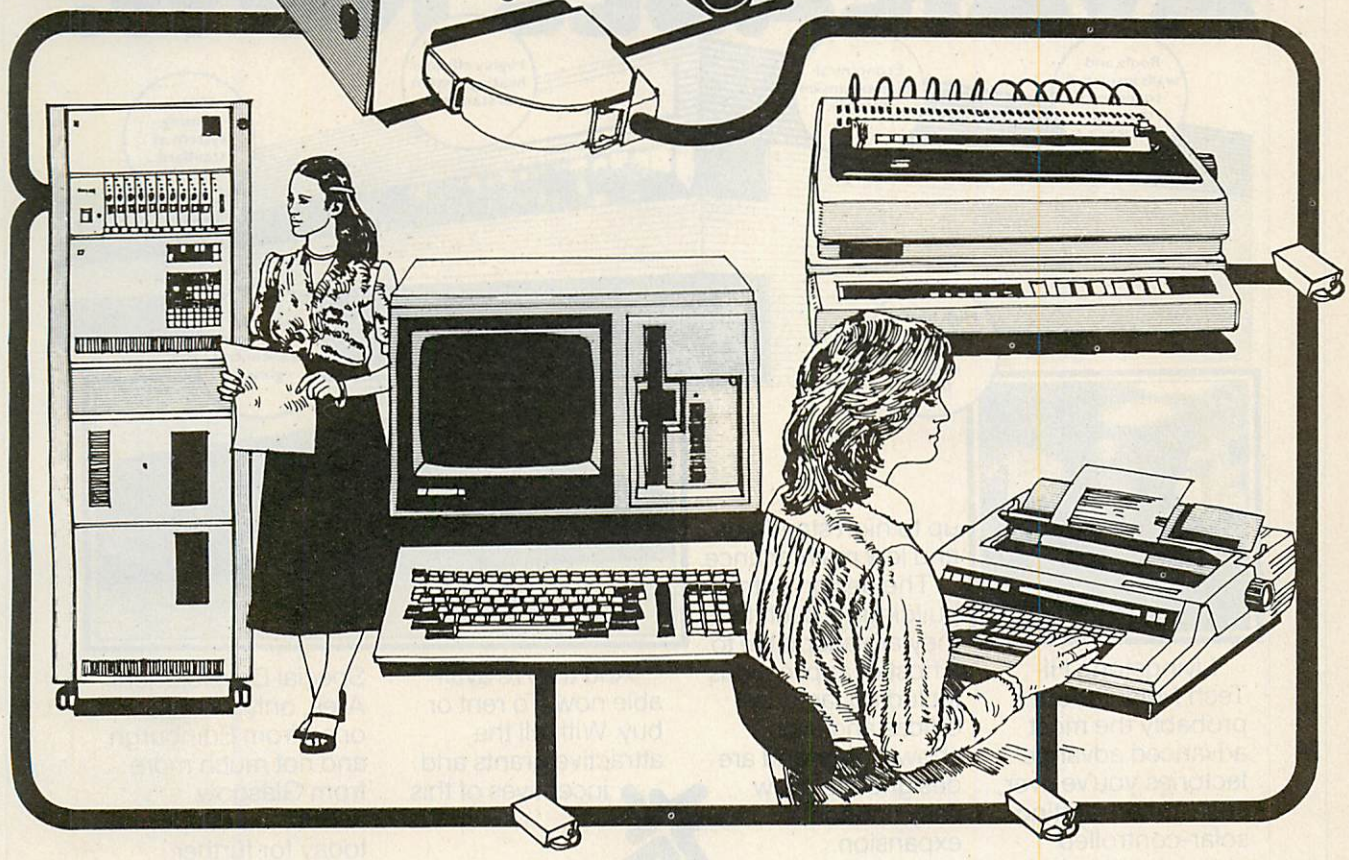

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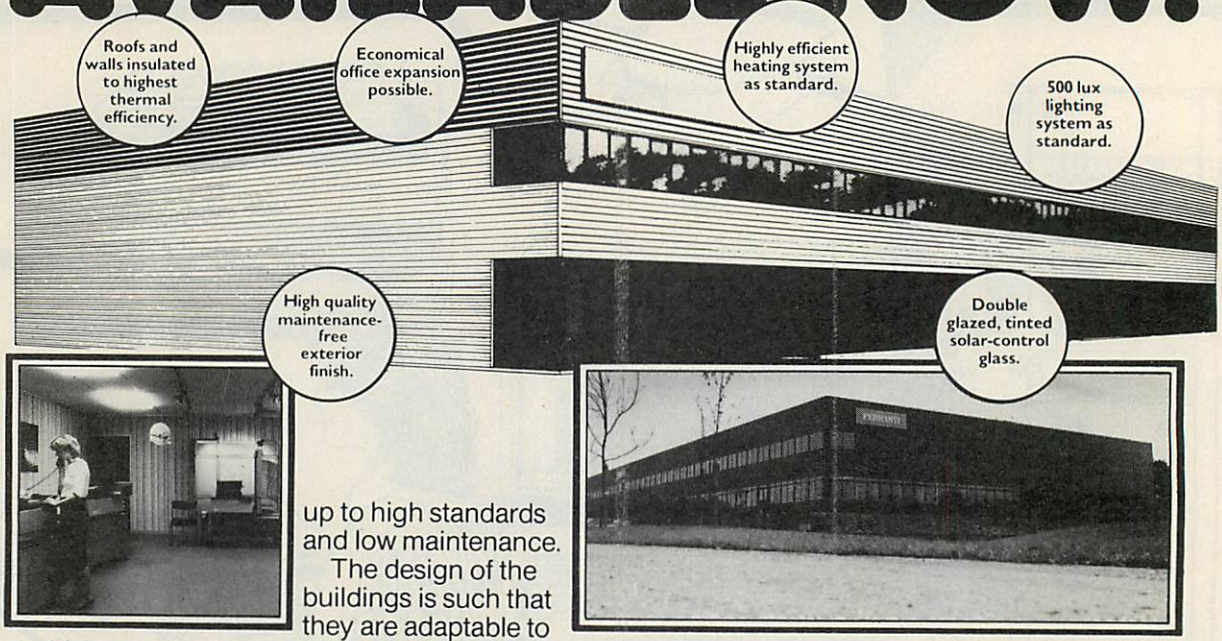
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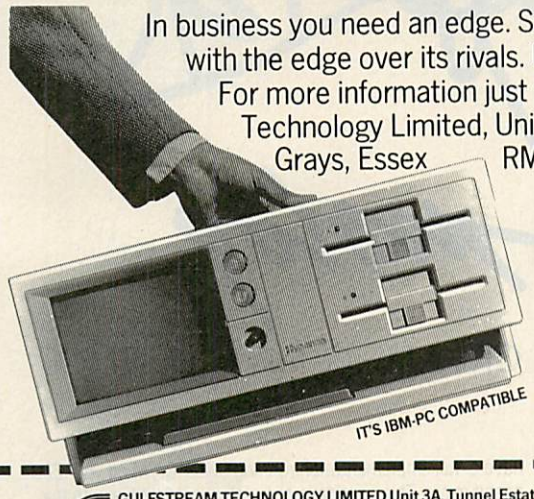

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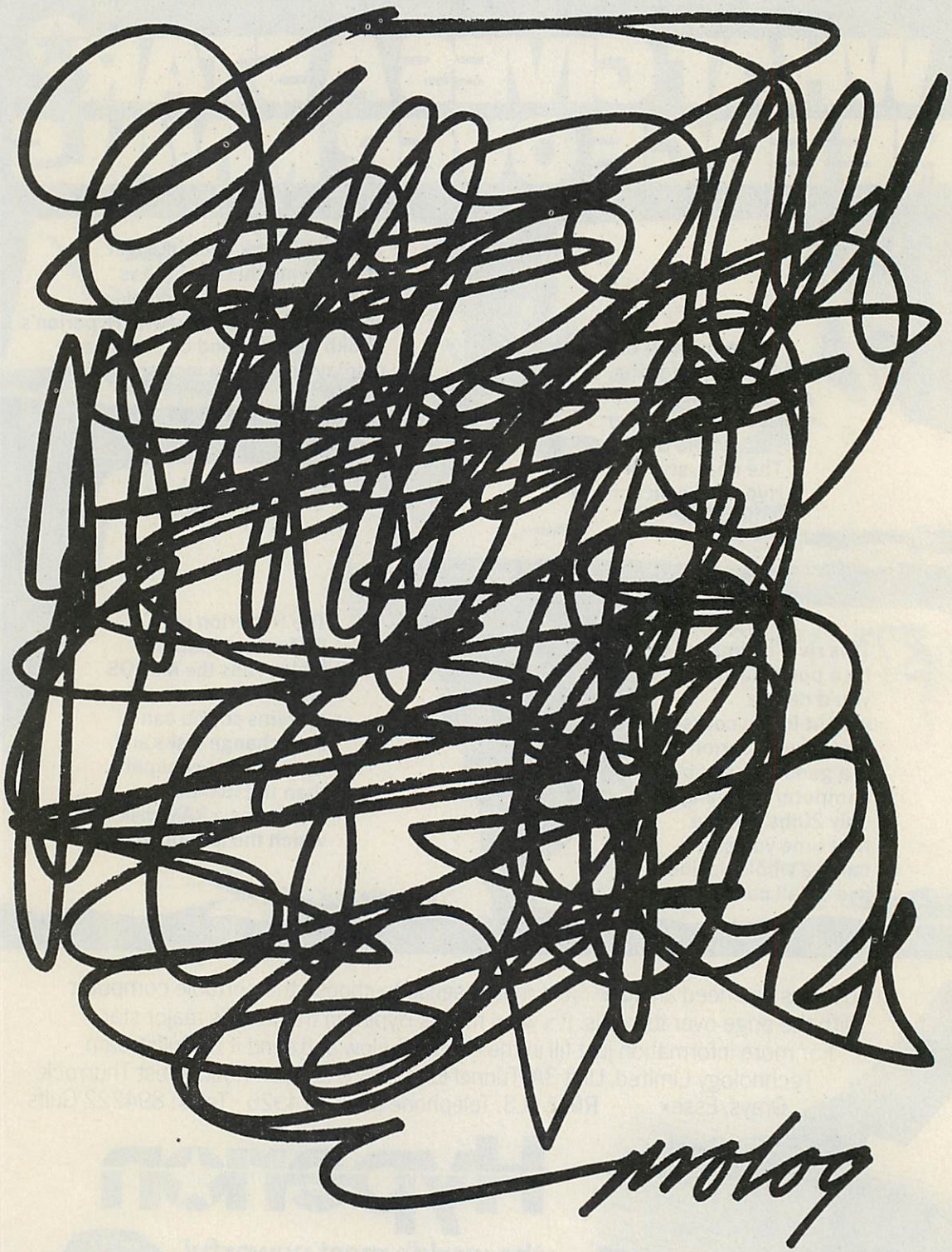

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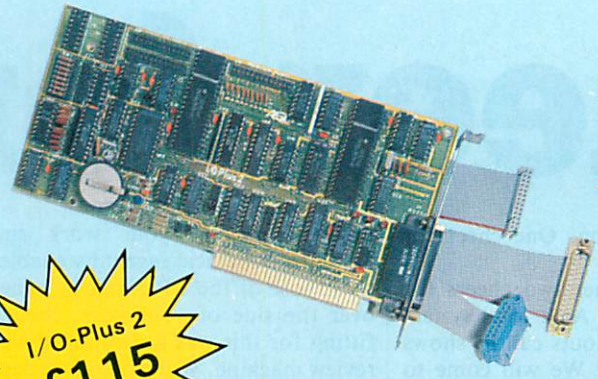

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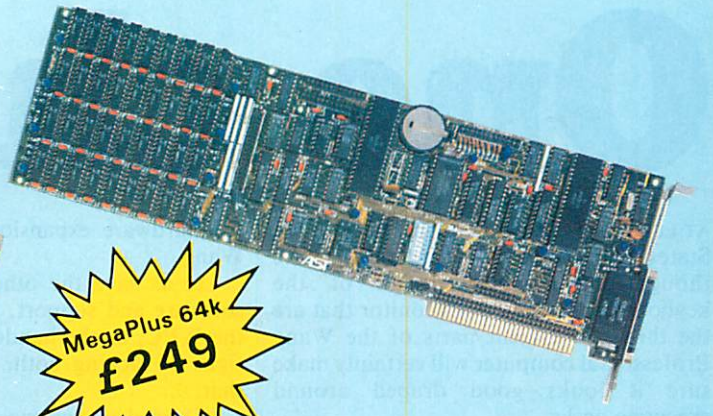

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One cheer for

AT LEAST the hardware people back in the States know what they are doing. The thoughtful industrial design of the keyboard, CPU unit and monitor that are the three constituent parts of the Wang Professional computer will certainly make sure it looks good draped around executive desks.

The good looks are more than skin deep: the modular construction of the main electronics, power supply and disc drives inside the welded steel mainframe of the CPU unit gives excellent accessibility. They have chosen a true 16-bit chip too, the Intel 8086, and left plenty of room for hardware expansion. One cheer for Wang.

Let us save the other two cheers for software and support. As a total system the WPC, as the handouts call it, shows signs of lacking both. We will come to that.

"Draped around executive desks" is not artistic licence because the WPC is capable of just that. Although the VDU can be planted conventionally on top of the CPU unit, Wang also supplies a spring-loaded mounting arm. It is a sort of beefed-up Anglepoise that clamps to the desk, letting you position the screen anywhere in three dimensions over your work surface. Similar mechanical ingenuity enables you to dispose of the CPU unit by hanging it over the side of your desk, though the fitting for this was not supplied with the review machine. Wang literature describes this unit as "compact", but at 38cm. by 59cm. by 16cm. it is only millimetres smaller than the classic S-100 mainframe of now distinctly old-fashioned dimensions.

With the hardware came five manuals in the now standard dwarf format established by IBM with its PC documentation. The Introductory Guide

Wang

Standing up to IBM in the market for large word-processing systems has been no mean feat, so can Wang do as well with its micro? Chris Bidmead reviews the Wang Professional.

describes the hardware and operating system, MS-DOS version 2. There are two volumes, a Reference Guide and a Training Guide, on the spreadsheet package called Multiplan. The word processor seems to be known — rather refreshingly in these days of Perfects, Magics, Supers and so forth — simply as The Word Processor and is also accompanied by a two-volume guide. The fifth volume is the manual for the Basic supplied with the machine, Microsoft's familiar MBasic with Wang enhancements to plot graphics and evoke soft music — well, loud noises actually — from the 2in. speaker concealed under the keyboard.

The basic WPC comes without a monitor and with only one disc drive, which makes one suspect it is more of a pricing convention than a piece of vendible kit. The review machine was the minimum configuration that you could reasonably call a stand-alone micro: dual floppies and a 12in. monochrome monitor with an additional character generator board to drive it. Disappointingly the drives offer no more than 362K each, hardly state-of-the-art for double-sided double-density diskettes.

In common with a number of 16-bit machines, the Wang is booted by latching the boot disc into the drive before powering up — a practice that will grate on the nerves of old computer hands. But as this is the only way of getting up and running presumably Wang has taken care of any surges likely to scribble on the disc. Five LEDs built in to the keyboard light up and go out one by one as the system goes through its internal checking.

The initialising software then searches for a drive with a disc in it and attempts to boot. This feature allows you to boot from drive B if drive A goes down, but would be more useful on a day-to-day basis if it were able to distinguish between system and non-system discs. As it stands, if both drives are loaded and latched the system disc must be in drive A or the boot fails. The Sirius works the same way — it's a missed opportunity.

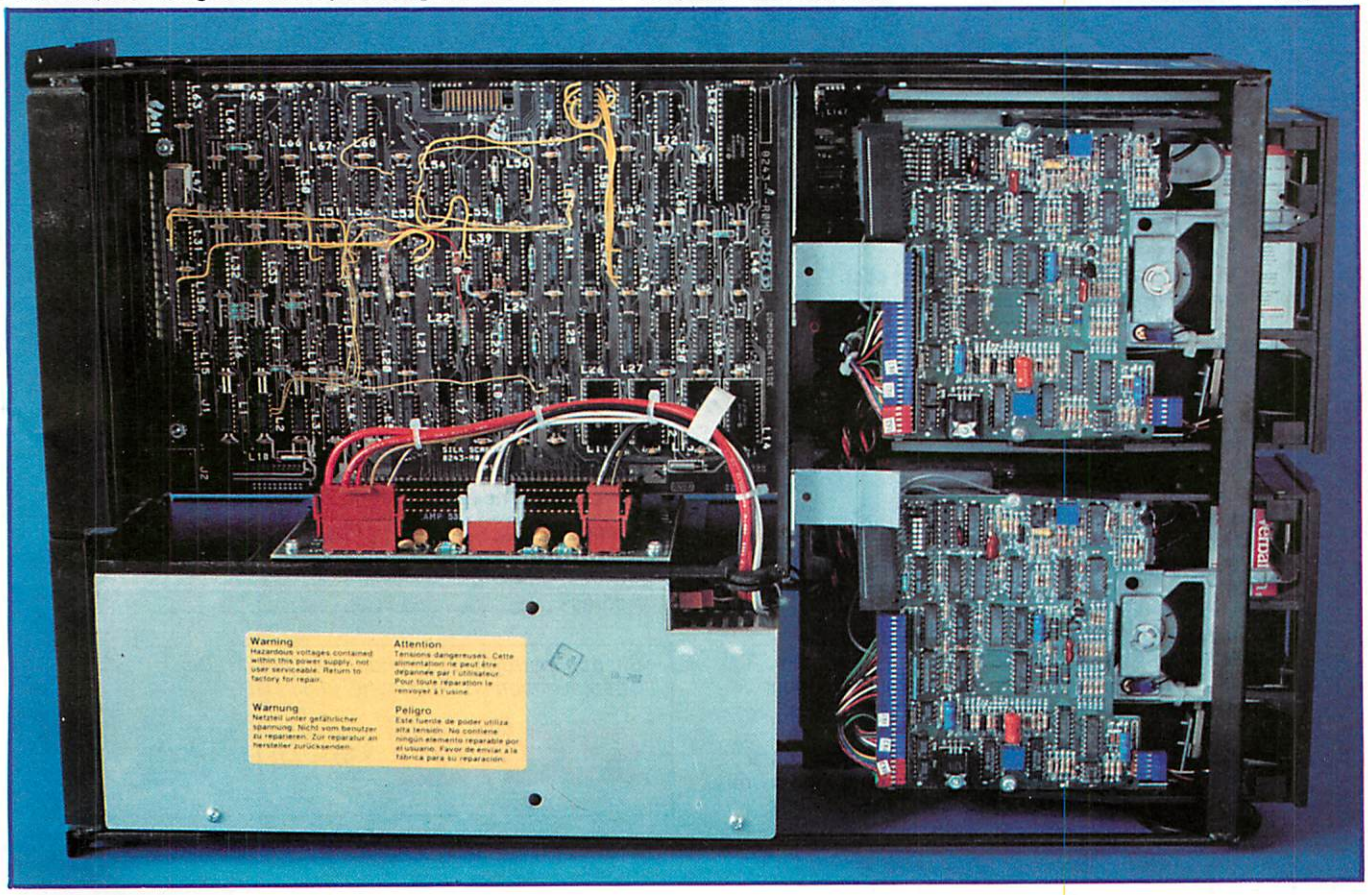
On booting successfully the monitor springs to life with a huge display of the manufacturer's name in neon-sized letters — in case you think you have bought an IBM PC? — and invites you to enter the date and time. You can skip this step with the Exec key, as distinct from the Return key which toggles the cursor between the date and time prompts.

From the very beginning you may never see the MS-DOS command line because a whirr of the system disc carries you straight into a menu offering you a selection of tasks. The 0.0 version number of the menu should be a warning to stand by for bugs, bomb-outs and general shortcomings. Reviewers absorb a lot of anguish in the cause of news-worthiness but I was looking forward to writing up MS-DOS version 2. I certainly did not expect to find the systems software as incomplete as subsequently appeared.

The first branch of the menu works as expected, taking you into a second level that offers a choice of the Word Processor or Multiplan. You need to change the disc to get at these programs but the process is properly prompted, and well proofed against the elementary error of inserting the wrong disc. However, things can go badly astray if you do not close the disc drive properly, or you insert a disc of the wrong format. The error messages are clear enough — "Drive A: not ready" or "Non-DOS disk error reading drive A" — but the action options offered do not make a lot of sense.

Rival operating-system vendor, Digital Research, points with some scorn at the MS-DOS Ignore? optional response to a trapped error. The criticism is that if you

(continued on page 93)



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● **Circle No. 175**

Wang

(continued from page 91)

ignore an error but allow the applications program to pick up again thinking that all is well, it is likely to go on and do some very strange things to your data. Wang, at this level at least, has quite rightly eliminated the option choice:

(A)bort or (R)etry?

Fine sentiments, but what does the offered choice actually mean? Changing the disc and retrying works fine, but if you decide to abort out of a wrong-format error the system is left with nowhere to go and simply hangs — even if you have corrected the error and substituted the right disc. So the option should read Retry or Hang, which is hust about where CP/M leaves you at this point. It is not easy to see what Microsoft's "improved error handling" brings in the way of real benefits.

The Wang Word Processor, embodied in a file called WP.Exe, will certainly appeal to beginners if only because of the way it is integrated with the keyboard. In fact the 18 function keys that run along the top of the usual QWERTY cluster are mostly engraved with WP functions like Srch, Replc, Indent and so forth. Unlike the IBM PC the keyboard is sensibly laid out for a touch typist, with the Return and Shift keys where typewriter-trained fingers expect to find them.

The screen is well suited to word processing, being absolutely stable with no trace of flicker or swim — although I prefer the characters to be a little larger than Wang's seven-by-seven dot matrix allows. Unfortunately there is a price to pay for the stability: when the screen scrolls the long persistence of the phosphor produces rather unpleasant smearing.

The anti-glare treatment of the glass surface is not very effective, but the swivel-arm mounting is movable in all directions and makes it reasonably easy to defeat reflection. The two controls on the front are for the operator to adjust the brightness and contrast without having to fumble round the back or in the entrails of the monitor.

WP.Exe has many of the characteristics of dedicated word-processing machines being robust and simple to learn. I would not quarrel with the assertion in the Wang literature that it "meets the fundamental word processiung *(sic)* needs of virtually any office environment" — no spelling checker apparently — but the features are wrapped in some curiously old-fashioned menu-driven ergonomics.

You get your first glimpse of this at the point of entry. If you cannot remember the name of the file you want to edit, the menu allows you to branch to the directory, here rather confusingly called the Document Index. But you have to wipe that screen in order to log on the chosen file, so there is no way of looking at the directory while you enter the file name. Better-mannered word processors evolving in the wider world of portable software have developed a distinct etiquette in these matters. At these prices you have the right to expect some or all of the following:

- At least to be able to see your file directory while you make your entry.
- Preferably to be able to move a cursor over the file names listed and select a file without retyping the name.
- A directory that gives you more information about the files than their MS-DOS prefix. Why not the data created, which MS-DOS records automatically against each file name, and possibly a comment on file contents?

Instead you get an entry prompt that insists you type your file name in upper case only, which is rather like a bus conductor refusing to give change. Another curiosity of the software is that there is that there is no way of exiting from a edit session without saving the edit you have made. What if you have messed up the file and want to go back to the original? Tough, says WP.Exe.

Insertion and deletion inside the text are also rather heavy-handed. To correct the typo "separatewords" in the top line of a page of prose, WP.Exe has to erase the whole screen from the word "separate" onwards to allow insertion of a single space. By way of compensation, print enhancements like underlining and bold-facing are very straightforward with the screen reflecting exactly what is going on. Instead of WordStar's ugly and uninformative embedded control codes, WP.Exe actually puts up the underlines on the screen. Boldface is represented by inverted video and, best of all, super- and sub-scripted characters shift vertically by half a line to appear exactly as on the printed page.

Whether in fact they print out like that I cannot say. Wang did not supply a printer, and is not able to tell me how to configure the software to drive a standard Diablo-type daisywheel through the RS-232 port. No documentation to cover this is available at the time of writing, and you will search in vain through the five manuals to discover even so much as the address of the port.

Like most of the software promised or currently offered with the Wang Professional, Multiplan is a Microsoft product. It is one more son of VisiCalc with some sophisticated additional features like two- and three-dimensional indexing, an extended Lookup function, and the ability to give names to blocks of cells. Like Supercalc II it allows sorting of rows of data, and there is an option to let alpha entry spill over into adjacent cells if they are empty — very useful for filling in headings and textual comments.

The two Multiplan manuals, one for learning and one for reference, are excellent although for some reason the Reference Manual lacks an index. The software is well designed with some nice ergonomic touches like the intelligent use of default values. Three minor criticisms: I cannot see why VisiCalc's alphanumeric reference scheme, for example, B7 to

(continued on next page)

Menu Madness

Beginners in this business — not the end-users, I mean mainframe manufacturers starting out fresh-faced and hopeful in the lucrative world of the micro — assume that their customers are rather simple people incapable of typing the word Basic into an operating-system command line. The unimaginative solution to this largely imaginary problem is to offer lots of user-friendly menus.

After eight seconds of disc activity up comes menu number one. With two easy keystrokes the user selects Program Development. The disc grinds again and a second menu appears. The user chooses Basic with a single keystroke. Again the disc spins into action and at last we are ready to go.

This sort of thing is helpful for the first day with a new computer, but with a floppy-disc machine particularly you very quickly tire of all these extra calls to the backing store. Unfortunately Wang has safety-pinned its menu software on to the operating system in a way that makes it hard to shake off.

According to the documentation it ought to be possible to create a clean unmenued version of the system disc by using the Format utility. You need the -s option to reserve special tracks on the newly formatted disc, to take the necessary system information, and copy across the files Command.Com, Bios.Com and MS-DOS.Com.

But if you try to boot up this new disc on the Wang the drive hangs with a message telling you that the command interpreter is missing or corrupt. Do not feel guilty — it is Wang that has botched Command.Com so that it dies unless the menu files are present. Command.Com is looking for a file called Menudrvr.Com, which will not work without Menu.Com. Menu.Com in turn needs Menu.Dat and Menu.Msg. So every system disc you create has got to have seven files on it before it will even boot.

Wang

(continued from previous page)

name a cell, has been replaced by the more long-winded numerical addressing, R7C2; hardware of this calibre really deserves software that can translate spreadsheets into graphs; and why in taking Multiplan to its bosom hasn't Wang U.K. patched it to offer £ signs as well as dollars.

To return to the main menu you will have to swap back to the system disc. If you then choose the second item on the menu, System Utilities, there will be no need to switch discs again because the routine file management it offers — renaming, copying, deleting and so forth — is supplied by .Com files on the same disc as the operating system.

On a floppy-disc machine this business of loading menus, handy for total beginners, soon becomes something of a hold-up. Although the menu system is ingeniously configurable, allowing you to alter the wording of the existing options or even write whole new menus of your own, I suspect that users will eventually prefer to work from the MS-DOS command line. Wang's so-called enhancement, the menu system, presents users with something of a problem here — see the Menu Mania box. But you can temporarily get to raw MS-DOS from the menus by choosing the DOS Command Processor option.

But Communications leads to a dead end, prompting for .Com files not supplied with the standard software. Program Development appears to offer you:

—Basic
—Debugger
—Editor
—Linker
—Library Manager
—Other

but of these options only Basic is supplied. The standard MS-DOS utilities like Edlin and Debug, the Microsoft equivalents of CP/M's Ed and DDT, are nowhere to be found. Of more immediate concern to the everyday user there was no Sys.Com, the routine that puts the system across to existing discs, and no Recover, the program to repair damaged files.

At this point my depression set in on behalf of the 5,000-odd customers to whom Wang U.K. hopes to be selling the machine this year. I will have to share my gloomy thoughts with you before this review is done. But for the moment let us contiue to look on the bright side and at the Basic, which is very comprehensive and easy to use.

To the main body of Microsoft Basic, with its extended Print Using statement and luxuriant string- and error-handling, Wang and Microsoft between them have added:

- Enhancements to the built-in editor, making it much easier to use.
- Dates and Times functions to fetch and carry calendar and clock data between Basic and the operating system.
- Colour and monochrome graphics handling.
- Sound and Play commands to give full control over the speaker under the keyboard.

The added editing features include easy entry of standard Basic commands like Auto, Print, Delete and so forth with only one or two keystrokes; single-key line editing using the dedicated editing keys like Insert and Delete; and best of all a full-screen editor. The last feature is very nice indeed: any section of code listed on the screen can be changed by moving the cursor into the line to be altered, making the modification, and hitting the return key to send the new version of the line to the buffer. You can even edit the line numbers, but this takes some getting used to as altering:

```
40 GOTO 300
```

to

```
45 GOTO 300
```

results in a pair of lines

```
40 GOTO 300
45 GOTO 300
```

Similarly the "erase to end of line" function provided by the Erase key will not remove a complete line from the buffer if you position the cursor in front of the line number, although it appears to do so on the screen. So it is not quite a built-in word processor.

The calendar and clock functions could not be easier. All it takes to display the time and date on the top line of the screen is:

```
10 CLS 'clear the screen
20 LOCATE 1,35 'position the cursor
30 PRINT "The time is " + TIME$ + " and
   today is " + DATE$
```

Add a fourth line

```
40 GOTO 20
```

and the time and date will refresh dynamically on the screen.

Unfortunately there was no graphics board with the review machine, so the graphics commands only produced Illegal Function Call messages. But Sound and Play produced music, of a sort, in abundance. Play is particularly easy to use, and you can set the keyboard carolling with a line as simple as:

```
10 PLAY "L4 O3 cccdcc O2 g2agab O3
   c2c2"
```

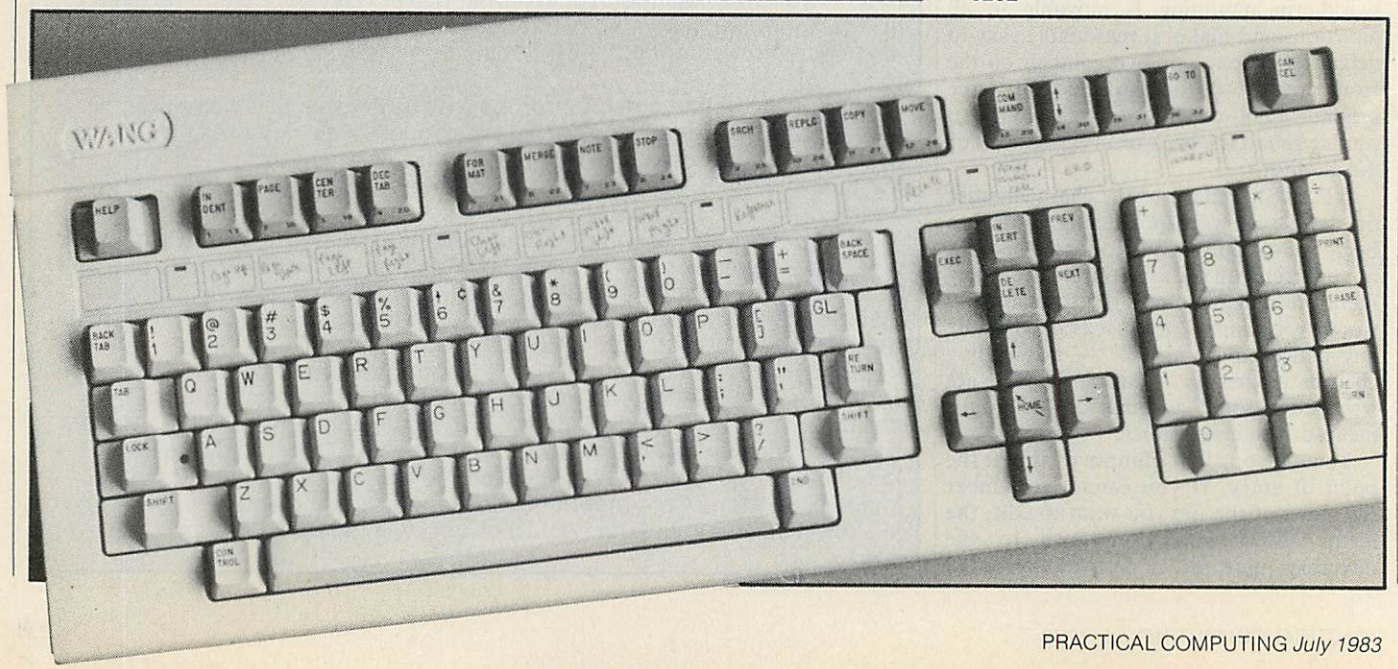
Specification

CPU: 8086
Operating system: MS-DOS 2.0
Memory: 128K expandable to 512K
Interfaces: Centronics, RS-232C

KEYBOARD
Type: 101-key detached, generating 224-character set
Features: Auto-repeat on all keys, geographic cursor key layout

DISPLAY
Type: 12in. monochrome green, long persistence, front-mounted brightness and contrast controls; optional suspension arm
Dimension: 640 × 225 dot resolution, optional graphics card produces 800 × 300 dot resolution

DISCS
Type: One or two 5.25in. 36K floppies, optional 10Mbyte Winchester



no documentation. It is like supplying someone with a box full of gold bars and omitting to give them a key to the box.

Another non-standard Basic command is Joy. Intrigued, I tentatively put my index finger on Func and hit the appropriately marked key. I must say I was most disappointed that waves of ectasy didn't wash over me, neither did the troubles of the world disappear. In fact, nothing happened at all. The command is a trick, and it certainly is not documented.

I never actually persuaded the Sord to Print anything in a colour other than the white on grey-green which is the default setting on power-up. There is some discussion as to how this works in the manual, but I found it too complicated — and I did try. It seems that you must define a colour for a particular character before printing it. Each subsequent appearance of that character then remains in that colour until the ultra-complicated STCHR command, followed by a parade of digits, is used again.

The amount of RAM free to Basic is a meagre 2.9K out of a total of 4K supplied. In addition there is 16K of video RAM, which apparently cannot be used directly from Basic.

The Sord has a separate video processor, the TMS-9918A, which is why the software supplied on cartridges looks so good. A total of 32 spites are possible, as are 32 separate colours. Sound is very good. It is normally emitted from the TV loudspeaker, or can be fed to a hi-fi. It also is produced by a separate dedicated chip, the Texas Instruments 76489. Chords are possible, as are a wide range of musical effects together with gunshot and explosion sounds.

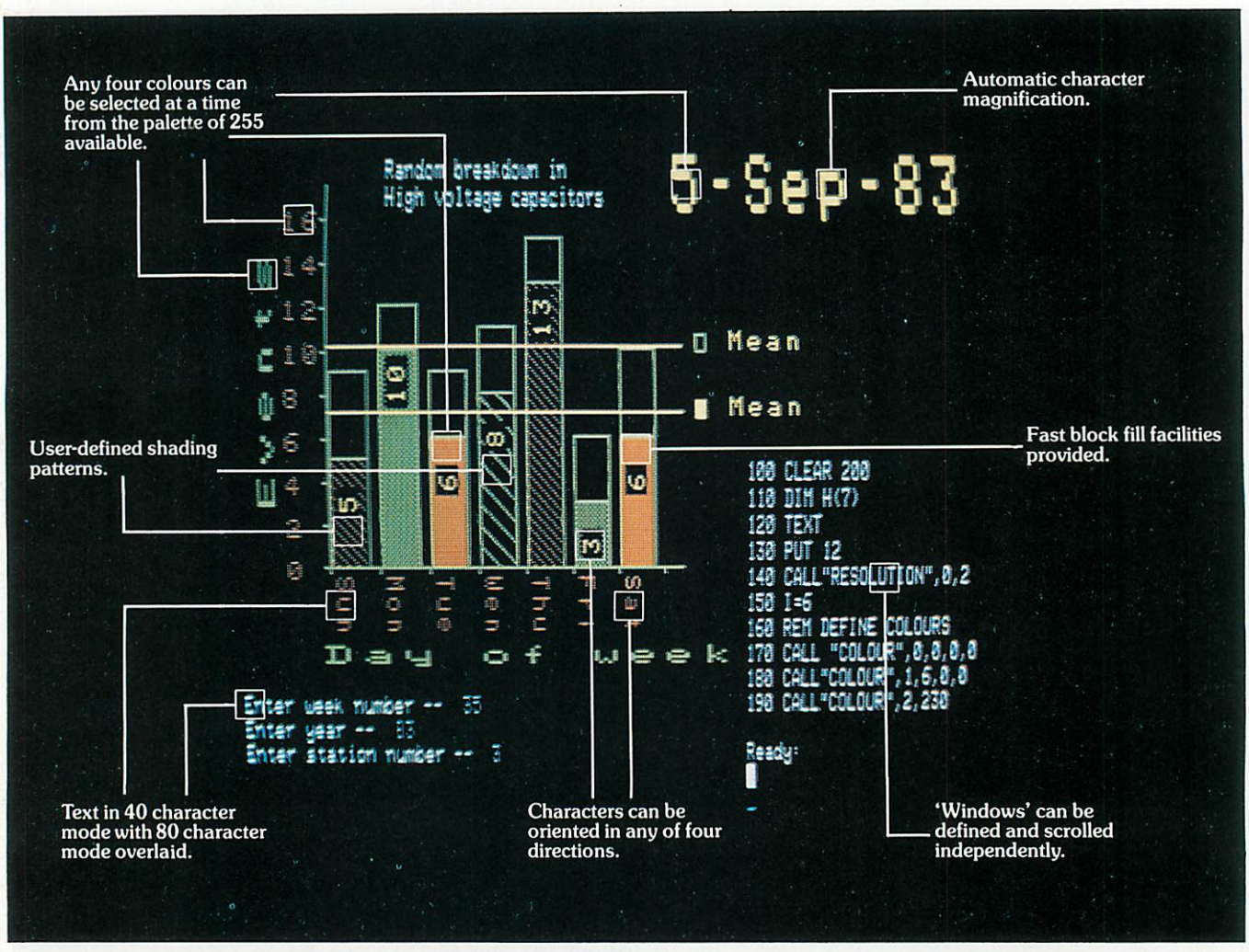
One feature of the M-5 that I particularly liked was the Time function, which returns the number of seconds elapsed since the machine was switched on. It has a number of potential applications, especially in games.

Imaginative use has been made of the control keys, every combination of which does something weird and wonderful. I was impressed by Control-C,D,E and F, which allow you to scroll the screen up and down as well as from left to right. However, if you lose anything off the screen in the course of this scrolling, it stays lost.

A colour-graphics mode can be entered by Control-Q. Here, characters printed to the screen appear as blocks of colour. Unfortunately, the same character does not correspond to the same block of colour, but it changes as it moves down the screen.

Conclusions

- **The Sord M-5 is a badly documented microcomputer aimed at the home and hobbyist market. Better documentation may be on its way soon from Sord's Irish subsidiary.**
- **The M-5 does not compete with existing machines on price, but does have an extremely good specification. Unfortunately the quality of the hardware is not matched by the tiny memory and the paucity of the Basic included with the machine.**
- **Software support for the Sord is curently lacking, though this situation should change soon.**


Any four colours can be selected at a time from the palette of 255 available.
Automatic character magnification.
Random breakdown in High voltage capacitors
5-Sep-83
Mean
Mean
User-defined shading patterns.
Fast block fill facilities provided.
100 CLEAR 200
110 DIM H(7)
120 TEXT
130 PUT 12
140 CALL"RESOLUTION",0,2
150 I=6
160 REM DEFINE COLOURS
170 CALL "COLOUR",0,0,0,0
180 CALL"COLOUR",1,6,0,0
190 CALL"COLOUR",2,230
Ready
Day of week
Enter week number -- 35
Enter year -- 83
Enter station number -- 3
Text in 40 character mode with 80 character mode overlaid.
Characters can be oriented in any of four directions.
'Windows' can be defined and scrolled independently.

A picture may be worth a thousand words but it still tells only half the story about graphics on the 380Z.

For a start, our standard graphics functions include point plotting, line drawing, instant block fill, block copying, offsetting, and Exclusive Or Plotting.

Then there is the important fact that our High Resolution Graphics is supported by Basic, Algol and Fortran. And since the Graphics is contained in its own 16K of RAM, every byte of user memory remains available for applications program use.

It is also worth noting that 380Z graphics are equally effective in monochrome — for 'colour' just read 'shades of grey'. Again there are 255 shades available, and there's also a very useful facility for fading up and down throughout the grey scale.

There are also the special effects — such as moving between graphics 'pages' for pseudo-animation, or the ability to produce 'instant' graphics by drawing them with the colour 'switched' off and then 'switching' on.

Next, not only can 380Z graphics pictures be saved on and retrieved from disc, they can also be output to one of a range of popular dot matrix printers.

Remember, too, that HRG is not a third-party add-on but designed, developed, and supported by Research Machines itself as an integral part of the 380Z.

And finally, we've now implemented GINO. So for the first time this well-established, professional suite of flexible, device-independent graphics software from the CAD Centre is available on a micro.

GRAPHICS MACHINE

If you are interested in graphics — for scientific, technical, and industrial research; or in secondary or higher education; or for design, engineering, or control, then you will be interested in the 380Z.

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● **Circle No. 177**

Editing sprites on the Commodore 64

Kevin Irving presents a program to help you develop fast-moving graphics.

AMONG the excellent features of the Commodore 64 are its sprite graphics. The manual method of creating sprites can be tedious and time-consuming, as you will know if you have ever tried it before.

Using a sprite editor can take the boring and repetitive part out of creating sprites and help you start your program off. All you need to do is draw your sprites on a grid using a series of easy-to-use editing keys and then leave the calculations to the computer. The program should prove to be a useful tool to anyone writing educational or games software.

There are two resolutions of sprites available to you, the normal 24 by 21 and the multi-colour 12 by 21. With normal sprites, if a bit is set then the sprite colour will be displayed in that position; if not you will see the background colour.

Multi-colour sprites are different. Each pixel of a multi-colour sprite takes up two bits, which allows four colours to be incorporated into one sprite at half of the normal resolution. The combination of the bits to produce the four colours are shown in table 1.

When you enter the sprite editing mode you are asked which type of sprite you are using. If you use a normal sprite then whenever you plot a point on the screen you will plot a point on your sprite. If you are using multicolour sprites then you will have to plot two points to specify which colour you wish to use. Each of the two points which you have to plot must start in an even column, as shown in figure 1.

Because multicolour sprites are at half the resolution of normal sprites you will find that each pixel is oblong rather than square. Expanding the sprites in the Y-direction will restore them to a square shape again but expanding them in the X-direction will make each pixel even longer.

To enter the program you should use the following procedure:

- Turn the computer off and on.
- Enter POKE 2560,0
  POKE 44,10 (return)
- Now either start typing from line 30, entering line 30 exactly as it is printed, or load what you have typed in so far and continue.

When you have finished typing in the program and it has been saved and tested, follow the next set of instructions:

- Turn the computer off and on.
- Load the program.
- Enter lines 10 to 23 exactly as printed.
- Save the program.
- Run the program. It crashes if you have entered a Rem incorrectly.

This procedure is used because the Rems take up ½K exactly. The program then moves the start of Basic up the memory 512 bytes and leaves some space in which the sprites are edited. The program will now start at line 30 and the Rems will be written over by sprite data. The details of the program are shown in table 2.

The subroutine which puts machine code on to Data lines might be useful to anyone writing an assembler or character editor. The routine will work on the Commodore 64, Vic-20 and, if you change the start and end of Basic Pokes, it will also work on the Pet. Similarly, the machine-code Load and Save routines should be useful in any such applications.

When you run the program, you will be faced with a menu of options. If you are starting eight new sprites then it may be useful to erase whatever sprites are currently in the memory using option 1. When you first load and run the program there will be garbage sprites which you may want to erase.

Once you have created your sprites option 2 will allow you to save them to tape and load them back at a later date. If the sprite editor was used to save them, then the sprite editor will load them.

When you select option 2 you should have your tape set to the correct place for loading. After a pause you will be asked

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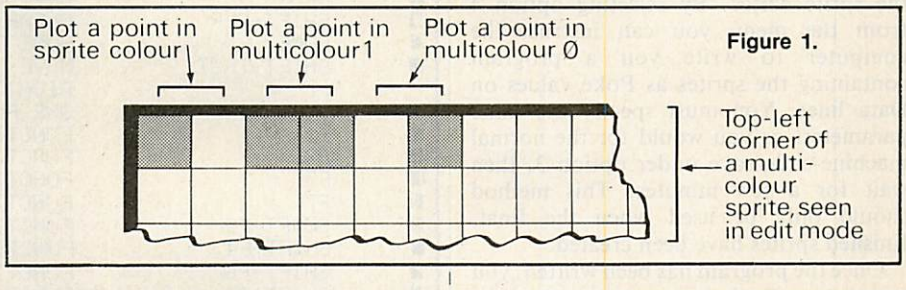
Plot a point in sprite colour
Plot a point in multicolour 1
Plot a point in multicolour 0
Top-left corner of a multi-colour sprite, seen in edit mode

Figure 1.

What is a sprite?

A sprite is a graphics character which is user-defined and which can be moved about on the screen without moving it bit by bit through screen FAM. Sprites are found bearing several names including "player-missile graphics" on the Atari 400 and 800, "movable object blocks" on the Commodore 64 and "sprites" on the TI-99/4A and Sord M5. As it is the simplest name, TI's "sprites" has stuck.

Sprites are used to provide fast animation. The conventional way to move an image on the screen is to rub it out and redraw it, say, one space to the left. This is slow, because the whole screen has to be redrawn, and jerky, because movement is normally one character at a time.

The problem is that the image you want to move, such as a rocket ship, occupies several lines of the screen so the data that produces it is scattered across RAM, interspersed with the background data.

The solution is to define the whole image as one block, store it somewhere else in RAM, then simply superimpose it on the screen. It can be moved as one block, simply by changing its X, Y co-ordinates.

With several sprites on the screen at once, priority and collision registers become important. Collision registers detect if two sprites occupy the same place. If this happens, priority registers decide which sprite takes priority. A sprite can appear to pass in front of or behind other sprites, and thus provide three-dimensional effects.

Defining a sprite is exactly like specifying a user-defined character: you draw your sprite on a grid on which each column corresponds to a different power of two. The values for the lit pixels are then added together to give a total value for each line of the sprite.

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for the name under which you saved the sprites. If you have forgotten the name just press the Return key, otherwise type in the name. You will be given the chance to cancel the loading process after this if you wish to.

Once the sprites are loaded you are given a display of the sprites and the opportunity to cancel any unwanted ones. If you keep a sprite you will be told the sprite number that it was saved as, and be asked to assign it a sprite number. This may be any number in the range of 0 to 7, and you will refer to that sprite by this number from then on. If a sprite has already been assigned to that number then it will be written over by the new one.

Once sprites have been loaded and modified or created you will want to save them to tape using option 3. Once you have selected the correct option from the menu you will be asked for the range of sprites to be saved to tape. If all of the sprites are to be saved then give the starting sprite as 0 and the ending sprite as 7. Once the range has been input you must enter the name under which they are to be saved. You can then either continue or abort the save.

Once they are saved you may load the sprites from your own program or from the sprite editor. By selecting option 4 from the menu you can instruct the computer to write you a program containing the sprites as Poke values on Data lines. You must specify the same parameters as you would for the normal machine-code save under option 3, then wait for a few minutes. This method should only be used when the final, finished sprites have been created.

Once the program has been written, you are given a final chance to return to the menu or continue and have the program. If you continue, you should save the Data line program, turn the computer off and on, then reload the program or sprite editor if you wish to do some more work. The top of memory and start of Basic are moved to an area of 4K free RAM between the Basic ROM and I/O controller chips. This area of memory is unused by the operating system and is just the correct length for storing the Data line program.

If you simply wish to look at the data values which would make up a sprite then option 5 from the menu will allow you to do so. You will then be asked which sprite you wish to see the values for. Answer with a number in the range of 0 to 7. Once it has been displayed you should press the space bar to return to the menu.

As soon as you enter the Edit mode, option 6, you will be asked which sprite you wish to work on. Reply with a number in the range of 0 to 7. Next you will be asked if you want the sprite to be a multi-colour.

You must then specify if the sprite is to be expanded in any direction, though this is only needed for a display of the sprite and will not affect the editing. The

Table 1.

Bits	Colour	Comment
00	background	colour value is taken from location 53281
01	multi-colour 0	Colour value is taken from location 53285
10	sprite colour	Colour value is taken from location 53287 + sprite number, 0-7
11	multi-colour 1	Colour value is taken from location 53286

Control characters for Commodore Pet, Vic and 64 machines.

SYMBOL	KEY PRESSES	MEANING	MACHINE
■	CTRL-1	SET COLOUR TO BLACK	VIC/64
■	CTRL-2	SET COLOUR TO WHITE	VIC/64
■	CTRL-3	SET COLOUR TO RED	VIC/64
■	CTRL-4	SET COLOUR TO CYAN	VIC/64
■	CTRL-5	SET COLOUR TO PURPLE	VIC/64
■	CTRL-6	SET COLOUR TO GREEN	VIC/64
■	CTRL-7	SET COLOUR TO BLUE	VIC/64
■	CTRL-8	SET COLOUR TO YELLOW	VIC/64
■	LOGO-1	SET COLOUR TO ORANGE	64
■	LOGO-2	SET COLOUR TO BROWN	64
■	LOGO-3	SET COLOUR TO PINK	64
■	LOGO-4	SET COLOUR TO GRAY 1	64
■	LOGO-5	SET COLOUR TO GRAY 2	64
■	LOGO-6	SET COLOUR TO LIGHT GREEN	64
■	LOGO-7	SET COLOUR TO LIGHT BLUE	64
■	LOGO-8	SET COLOUR TO GRAY 3	64
■	CTRL-RVS ON	SET REVERSED TEXT	PET/VIC/64
■	CTRL-RVS OFF	SET NORMAL TEXT	PET/VIC/64
■	CRSR↓	MOVE CURSOR DOWN ONE LINE	PET/VIC/64
■	CRSR→	MOVE CURSOR RIGHT ONE LINE	PET/VIC/64
■	CRSR↑	MOVE CURSOR UP ONE LINE	PET/VIC/64
■	CRSR←	MOVE CURSOR LEFT ONE LINE	PET/VIC/64
■	SHIFT-CLR	CLEAR THE SCREEN	PET/VIC/64
■	HOME	HOME THE CURSOR	PET/VIC/64
■	SHIFT-INST	MOVE THE CURRENT LINE AT RIGHT OF THE CURSOR RIGHT ONE PLACE	PET/VIC/64
■	F1	FUNCTION KEY 1	VIC/64
■	F3	FUNCTION KEY 3	VIC/64
■	F5	FUNCTION KEY 5	VIC/64
■	F7	FUNCTION KEY 7	VIC/64
■	SHIFT-F2	FUNCTION KEY 2	VIC/64
■	SHIFT-F4	FUNCTION KEY 4	VIC/64
■	SHIFT-F6	FUNCTION KEY 6	VIC/64
■	SHIFT-F8	FUNCTION KEY 8	VIC/64
■	CTRL-N	SET LOWER CASE MODE	VIC/64
■	SHIFT-2, DEL, CTRL-RVS ON, SHIFT-N, CTRL-RVS OFF,		
	SHIFT-2, DEL	SET UPPER CASE MODE	VIC/64
■	CTRL-H	DISABLE SHIFT-LOGO	VIC/64
■	CTRL-I	ENABLE SHIFT-LOGO	VIC/64

```
10 REM ********************************
11 REM**************************************
12 REM** COMMODORE 64 SPRITE EDITOR. **
13 REM**************************************
14 REM**************************************
15 REM**************************************
16 REM****** AUTHOR:KEVIN IRVING ******
17 REM** (C) COPYRIGHT JANUARY 1983. **
18 REM**************************************
19 REM**************************************
20 REM***** PROGRAM LENGTH=11.1 K *****
21 REM**************************************
22 REM**************************************
23 REM
30 REM * SPRITE EDITOR *
90 GOSUB4100
95 PRINTCHR$(8);CHR$(142)
100 GOSUB4800
140 IFPEEK(44)=8ANDPEEK(43)=1THENPOKE44,10:GOTO210
145 IFPEEK(2560)=0ANDPEEK(2561)=25ANDPEEK(2562)=10ANDPEEK(2565)=143THEN210
150 PRINT"■■■                ERROR:"
151 PRINT"_____3":
155 PRINT"BECAUSE BASIC DOES NOT START AT LOCATION";
160 PRINT"2049($801) THIS PROGRAM CANNOT CONTINUE.";
180 PRINT"SWITCH THE COMPUTER OFF AND ON THEN LOAD";
190 PRINT"UP THIS PROGRAM AGAIN.                ";
200 PRINT"■■■■■■■■";:NEW
210 PRINT"■■■AUTHOR■: ■EVIN IRVING.";:FORI=0TO2000:NEXT
300 GOSUB4100:GOSUB4800
```

```
305 PRINT"■    THE SPRITE EDITING OPTIONS ARE:"
306 PRINT"    ──────────────────────────"
310 PRINT"■■  1.)■ ERASE ALL EXISTING SPRITES"
315 PRINT"■   2.)■ LOAD SPRITES FROM TAPE"
320 PRINT"■   3.)■ SAVE SPRITES TO TAPE"
325 PRINT"■   4.)■ WRITE A PROGRAM CONTAINING"
330 PRINT"         SPRITE POKE VALUES ON DATA"
333 PRINT"         LINES"
335 PRINT"■   5.)■ DISPLAY THE POKE VALUES FOR A              SPRITE"
340 PRINT"■   6.)■ EDIT/CREATE A SPRITE"
345 PRINT"■   7.)■ COPY SPRITES"
346 PRINT"■   8.)■ EXCHANGE SPRITES"
347 PRINT"■   9.)■ QUIT"
350 PRINT"■■■SELECT: ■■■ ■■■
```

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Lines 500-632. Initialise edit routine.
Lines 633-636. Update screen display.
Lines 637-667. Check input command and perform it.
Lines 670-673. Make sprites upside down.
Line 680. Reverse all colours.
Lines 690-697. Invert sprite, mirror image.
Lines 700-705. Rotate sprite left.
Lines 710-715. Rotate sprite right.
Lines 720-723. Rotate sprite up.
Lines 730-733. Rotate sprite down.
Lines 740-770. Display decimal Poke values for a sprite.
Lines 800-950. Save sprites.
Lines 800-865. Ask for range of sprites to be saved.
Line 867. Move sprites which are to be saved to Himem.
Lines 870-900. Set up screen display to save sprites and continue running program.
Lines 910-935. Set up memory for save.
Line 940. Start save.
Lines 1000-1160. Load sprites from tape.
Lines 1000-1075. Input name and load sprites.
Lines 1080-1160. Identify sprites and allow user to cancel those not wanted.
Lines 1200-1290. Copy one sprite over another.
Lines 1300-1330. End the program.
Lines 1400-1470. Exchange two sprites.
Lines 1500-1630. Write a program with sprites as values on Data lines.
Lines 4000-4040. Customised single-key entry routine.
Lines 4100-4120. Clear screen and display header.
Lines 4200-4210. Wait until space bar is pressed then return to menu.
Lines 4300-4340. Machine-code load routine.
Lines 4600-4630. Input a string.
Lines 4700-4720. Get a Y/N reply.
Lines 4800-4890. Initialise variables/memory.
Lines 4900-4930. Display sprtie matrix grid.
Line 5000. Ask if user wants to continue.
Lines 5100-5320. Subroutine for storing machine code on to Data lines.
Lines 63000-63005. Machine-code routines used.

Program variables.

I,J,K,L,M, — Various uses.
IH — Highest ASCII value of input.
IL — Lowest ASCII value of input.
IV — ASCII of input.
IV — With Y/N reply 1 = Y, 0 = N.
A$ — Various uses.
S — Sprite being edited/created.
V — Starting address of video controller chip.
SA — Start address of sprite being edited.
P1 — Horizontal position of editing cursor.
P2 — Vertical position of editing cursor.
PA — Address of character under cursor.

(table continued opposite)

(listing continued from previous page)

```
739 REM*****DISPLAY POKE VALUES*****
740 PRINT"■          DISPLAY POKE VALUES"
741 PRINT"                              "
742 PRINT"■■WHICH SPRITE DO YOU WANT THE POKE VALUES":
743 PRINT"DISPLAYED FOR <0-7>? ■[ ]■■■";:IL=48:IH=55:GOSUB4000
744 GOSUB4100:PRINT"■■THE POKE VALUES FOR SPRITE"IV-48"ARE:■■";PRINT"      ";
745 J=1:FORI=2048+(IV-48)*64TO2111+(IV-48)*64
750 PRINTRIGHT$(STR$(PEEK(I)),LEN(STR$(PEEK(I)))-1)",";
753 IFI-(IV-48)*64=2111THENPRINT"■ "
755 IFPEEK(211)<35THENPRINT:PRINT" ";
760 NEXT
770 GOTO4200
799 REM*****SAVE SPRITES*****
800 PRINT"■              SAVE  SPRITES"
805 PRINT"                              "
825 PRINT"■   YOU MUST TELL ME THE RANGE OF SPRITES":
830 PRINT"TO BE SAVED. EG."
835 PRINT" START=3,END=5 WILL SAVE SPRITES 3,4 & 5"
840 PRINT"■■ENTER THE SPRITE RANGE TO BE SAVED"
845 PRINT"  START<0-7>■ [ ]■■■";:IL=48:IH=55:GOSUB4000:PRINT
850 SS=IV-48:PRINT"     END<"RIGHT$(STR$(SS),1)"-7>■ [ ]■■■";:IL=IV:GOSUB4000
860 SE=IV-47:PRINT:PRINT"    NAME ■[                    ]■■■■■■■■■■■■■■■■■■■■";
865 IL=32:IH=95:II=15:GOSUB4600:PRINT:GOSUB5000:IFIV=0THEN300
867 FORI=SS*64TOSE*64:POKE49152+I,PEEK(2048+I):NEXT
870 PRINT"■";:IFPEEK(1)=55THENPRINT"■       PRESS PLAY & RECORD ON TAPE"
880 PRINT"■■■■SAVE"CHR$(34);S$;CHR$(34)",1,1"
890 PRINT"■■■■■■■POKE43,1:POKE44,10:POKE45,"PEEK(45)":POKE46,"PEEK(46)
900 PRINT"■■CONT■";POKE198,10:FORI=0TO9:POKE631+I,13:NEXT
910 POKE44,(49152+SS*64)/256:POKE43,(49152+SS*64)-PEEK(44)*256
920 POKE1001,(49152+SE*64)/256:POKE1000,(49152+SE*64)-PEEK(1001)*256
935 POKE45,PEEK(1000):POKE46,PEEK(1001)
940 END
950 GOTO300
999 REM*****LOAD SPRITES FROM TAPE*****
1000 PRINT"■              LOAD  SPRITES"
1005 PRINT"                              "
1020 PRINT"■■■                PLEASE WAIT"
1030 FORI=0TO511:POKE49152+I,0:NEXT
1040 GOSUB4100:PRINT"■■■    ENTER THE NAME UNDER WHICH YOU SAVED":
1045 PRINT"THE SPRITES.JUST PRESS THE RETURN KEY IF":
1050 PRINT"THE NAME IS NOT KNOWN."
1060 PRINT"■■   NAME ■[                    ]■■■■■■■■■■■■■■■■■■■■";
1063 IL=32:IH=95:II=15:GOSUB4600:PRINT:GOSUB5000:IFIV=0THEN300
1065 PRINT"■■";:IFPEEK(1)=55THENPRINT"           ■PRESS PLAY ON TAPE■"
1066 IFPEEK(1)=55THEN1066
1070 A=1080:GOTO4300
1080 GOSUB4100:GOSUB4800
1085 FORK=0TO7:IFPEEK(49215+K*64)=0THENNEXT:GOTO300
1090 GOSUB4100:GOSUB4900:AD=49152+K*64
1100 POKE871,AD/256:POKE870,AD-PEEK(871)*256:SYS835
1110 PRINTTAB(26)"■■THIS WAS SAVED"
1115 PRINTTAB(26)"■AS SPRITE"K"■."
1120 PRINTTAB(26)"DO YOU WANT TO"
1125 PRINTTAB(26)"■USE IT <Y/N>?":GOSUB4700:IFIV=0THENNEXT:GOTO300
1130 PRINT:PRINTTAB(26)"PLEASE ASSIGN"
1135 PRINTTAB(26)"THIS SPRITE A"
1140 PRINTTAB(26)"NUMBER <0-7>■:■";:IL=48:IH=55:GOSUB4000
1150 FORJ=0TO62:POKE2048+(IV-48)*64+J,PEEK(AD+J):NEXT
1160 NEXT:GOTO300
1199 REM*****COPY SPRITES*****
1200 PRINT"■              COPY  SPRITES"
1205 PRINT"                              "
1210 PRINT"■■■ENTER SPRITE TO BE COPIED FROM <0-7> ■[ ]■■■";:IL=48:IH=55
1220 GOSUB4000:S3=IV-48:S1=2048+S3*64
1230 PRINT"■ENTER SPRITE TO BE COPIED TO   <0-7> ■[ ]■■■";
1240 GOSUB4000:S4=IV-48:S2=2048+S4*64
1250 PRINT"■■■■■      SPRITE"S3"WILL BE WRITTEN OVER"
1260 PRINT"       SPRITE"S4"AND THE OLD SPRITE"S4
1270 PRINT"      WILL BE DESTROYED.■"
1280 GOSUB5000:IFIV=0THEN300
1290 FORI=0TO62:POKEI+S2,PEEK(I+S1):NEXT:GOTO300
1299 REM*****END*****
1300 POKE650,255
1310 PRINT"■■    THIS PROGRAM HAS ENDED. THE START OF":
1320 PRINT"BASIC HAS BEEN MOVED UP TO LOCATION 2560(*A00)."
1325 SYS52978
1330 PRINT"■■■■■■";:END
1399 REM*****EXCHANGE SPRITES*****
1400 PRINT"■              EXCHANGE  SPRITES"
1405 PRINT"                              "
1410 PRINT"■■     PLEASE ENTER THE NUMBERS OF THE TWO":
1420 PRINT"SPRITES TO BE EXCHANGED.■"
1430 PRINT"■   1ST SPRITE <0-7> ■[ ]■■■";:IL=48:IH=55:GOSUB4000:S3=IV-48
1435 PRINT:S1=2048+S3*64
1440 PRINT"   2ND SPRITE <0-7> ■[ ]■■■";:GOSUB4000:S4=IV-48:S2=2048+S4*64
1450 PRINT:PRINT"■■■■     PLEASE WAIT WHILE I EXCHANGE"
1455 PRINT"        SPRITE"S3"WITH SPRITE"S4"■."
1460 FORI=0TO62:M=PEEK(S1+I):POKES1+I,PEEK(S2+I):POKES2+I,M:NEXT
1470 GOTO300
1499 REM*****WRITE PROGRAM CONTAINING SPRITES ON DATA LINES*****
1500 PRINT"■   WRITE A PROGRAM CONTAINING SPRITE"
1505 PRINT"                                      "
1520 PRINT"         POKE VALUES ON DATA LINES"
1525 PRINT"                                      "
1530 PRINT"■■   YOU MUST TELL ME THE RANGE OF SPRITES":
1535 PRINT"TO BE STORED ON DATA LINES. EG."
1540 PRINT" START=3,END=5 WILL STORE THE POKE"
1545 PRINT" VALUES FOR SPRITES 3,4 & 5 ON DATA"
1550 PRINT" LINES."
1560 PRINT"■■ENTER THE SPRITE RANGE TO BE SAVED"
1565 PRINT"  START<0-7>■ [ ]■■■";:IL=48:IH=55:GOSUB4000:PRINT
1567 DS=(IV-48)*64+2048:SS=IV-48
```

```
1570 PRINT"    END<"RIGHT$(STR$(SS),1)"=7)■ [ J■■■":IL=IV:GOSUB4000
1575 PRINT:DE=(IV-47)*64+2048
1580 PRINT"■■     I NOW NEED TO KNOW THE LINE NUMBER"
1585 PRINT"AT WHICH I SHALL START WRITING THE DATA"
1590 PRINT"LINES."
1600 PRINT"■■  STARTING LINE NUMBER ■[      J■■■■■■■■":
1610 IL=48:IH=57:II=5:GOSUB4600:LN=VAL(S$):PRINT
1613 GOSUB5000:IFIV=0THEN300
1615 GOSUB4100:PRINT"■■■■     WAIT WHILE I WRITE YOUR PROGRAM"
1620 IFLN>65535THEN5175
1630 SP=49152:GOTO5100
3999 REM*****INPUT ROUTINE*****
4000 RE=0
4001 POKE198,0
4002 PRINT" ■":GOSUB4010
4003 PRINT"■":GOSUB4010
4004 PRINT"■■":GOSUB4010
4005 PRINT"■■":GOSUB4010
4006 IF)<99THEN4002
4007 PRINTCHR$(IV);:WAIT197,64:FORI=0TO20:NEXT:RETURN
4010 IFI=99THENRETURN
4015 FORI=0TO20:GETA$
4020 IFA$=""THENNEXT:RETURN
4030 IV=ASC(A$):IFIV=13ANDRE=1THEN4040
4035 IF(IV<1ORIV>IHTHENNEXT:RETURN
4040 I=99:RETURN
4099 REM*****DISPLAY HEADER*****
4100 PRINT"■■■       COMMODORE 64 SPRITE EDITOR       ":
4110 PRINT"                                "
4120 RETURN
4199 REM*****PRESS SPACE BAR TO GO TO MENU*****
4200 PRINT"■■■■■■■■
```

A tale of two cassettes

Ian Stobie contrasts a pair of packages for the Dragon 32.

THIS IS THE STORY of two word-processing packages for the Dragon, one crude and limited, the other wonderful.

Textstar costs £12.95 and is written by PSS of Coventry. Telewriter costs £49.95, was originally written in the United States and is available in the U.K. from Microdeal. Telewriter is the wonderful one.

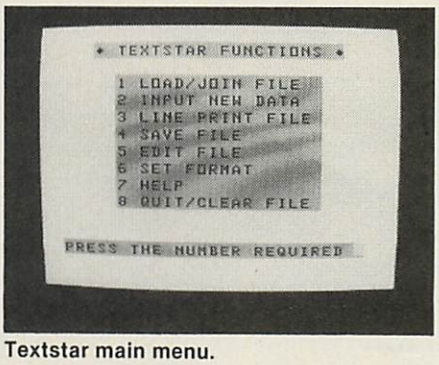
Rather than writing off Textstar as inferior it is interesting to compare the two products. Requirements for word processing in the home differ. Some people really want a practical product to produce letters and longer documents on a decent printer. Others just want a taste of word processing and never intend to use their computer seriously in this way. So there is an honest role for the cheap but fairly impractical product, a toy version of things used in real offices.

The Dragon is good home machine on which to try out word processing as it has a proper keyboard with normal full-travel keys, not a miniturised rubber pad. But in other ways the Dragon is not ideal, and the screen in particular has its limitations. The standard display shows 16 lines of only 32 characters, whereas the typical letter produced on a typewriter is at least 50 characters across. Telewriter solves this problem with a virtuoso piece of software writing, which produces — by software alone — a 51-character by 24-line display with true upper-case and lower-case letters.

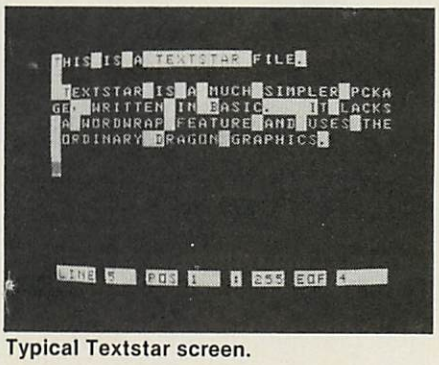
But there are some problems the software writers cannot solve. The Dragon's actual display area covers a far smaller proportion of the TV screen than most comparable small micros. Furthermore the screen display is not very good, especially on the earlier machines off the production line. I tried out three machines before I found one I could bear to look at for very long — number 88059 was much better than number 9. Even so, the photos for this article were taken from a monitor, not a TV.

Textstar from PSS comes on cassette in a small video-style case just like one of PSS's games. The only documentation you get with it for your £12.95 is a single sheet of paper printed on both sides. The program is in Basic so you CLoad it. There is no disc version so the program and any text files you create are kept on cassette. Running the program brings up the main menu:

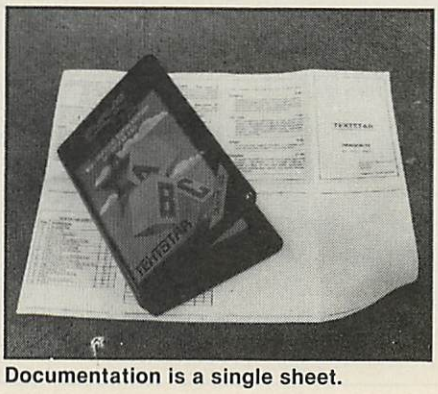
1 Load/Join File
2 Input Data
3 Line Print file
4 Save file
5 Edit file
6 Set format
7 Help
8 Quit/clear file



Textstar main menu.


THIS IS A TEXTSTAR FILE.
TEXTSTAR IS A MUCH SIMPLER PCKA
GE, WRITTEN IN BASIC. IT LACKS
A WORDWRAP FEATURE AND USES THE
ORDINARY DRAGON GRAPHICS.
LINE 5 POS 1 : 255 EOF

Typical Textstar screen.



Documentation is a single sheet.

Selecting 2 clears the screen except for an amber flashing cursor, and then you can start entering your text. Hitting Shift-0 is necessary to make the Dragon keyboard recognise the difference between shifted and unshifted letters. Textstar represents shifted upper-case letters on the screen as inverted black on white — or more accurately pale green — capitals. The lower-case letters are just pale green on black capitals so the display is terrible for word processing, but no worse than normal for the Dragon. Turning the colour right down helps.

Textstar cannot handle wordwrap, so if you type a word which extends over the end of the line it just continues on the next line regardless. To make things even more difficult to read, spaces between words are displayed as pale-green blobs. It is awful.

There are a few good things to say about Textstar. It does have the ability to handle Basic programs, and I find the standard Dragon Basic editor particularly tedious to use. Textstar's Find and Replace is useful for locating and changing names, and you can also sort lines into numeric order. It all happens quite slowly though, as you can imagine with a simple Basic word processor. Textstar would be acceptable as a toy word processor to let people get the feel of word processing — if it were cheaper.

American origins

Telewriter costs nearly £50 and is a superb piece of software, up to full professional standards within the limitations of the machine. Written originally for the Tandy Color Computer by Cognitec in the United States, it has been adapted for the Dragon by Microdeal in the U.K. Changes are necessary because the two machines are not absolutely identical in programming terms. Telewriter is written in machine code. A Tandy version is also available from Microdeal.

Like Textstar, Telewriter also comes on cassette and uses cassette files. According to Microdeal a disc version is under development. Microdeal told me that existing registered users of the package will be able to buy a disc upgrade to Telewriter for £10 to £15, as soon as

Dragon brings out its own discs. Telewriter comes with a 60-page manual divided into a tutorial section and a reference section. It is unexciting but clear and has an index.

The cassette contains four versions of the program and a utility to enable you to use Telewriter to edit Basic program files. The four versions are for different printers — Telewriter is designed to work with most common printers. Used with the Epson MX-80, as in our case, the package is capable of handling double-struck, condensed, and enlarged founts as well as normal output.

Having loaded the appropriate version of Telewriter from tape with CLoad, you type Exec to set the program running, which brings up a copyright statement. Hitting the Enter key brings up the main menu. Considering how good the rest of the program is the main menu is not very grand — a list of the available options in inverse video: Create; Edit; Save; %Save, that is save block; Read In; Append; Verify; Format; and Words.

Status lines

At the bottom of the main menu screen are three status lines. Space tells you how much memory remains free for your text file and is updated each time you return to the main menu. Initially you have a generous 18,500 characters available, which is the equivalent of about 20 A4 pages. File tells you the name of the file you are working on, and is initially blank until you read or save a file. Lines tells you how many lines there are in your text file, and is also initially blank.

Once you have created some text, returning to the main menu and selecting the Words option causes Telewriter to count up both the number of lines and the number of words in your file and display them at the bottom of the screen Counting is a tedious task and is an excellent feature to include in a word processor, though it is often left out.

Menu options are selected by typing in the first letter of the displayed word. So if you type C the screen clears except for an L-shaped cursor and you can start creating a new text file. Lower case is activated in the normal Dragon way by hitting Shift-0, and is displayed properly in black on white on the excellent Telewriter 51-by-24 size software-driven screen. There is no noticeable delay so you can still type at your normal speed. Words typed beyond the end of the line are automatically carried over so none are left incomplete, but you can turn this feature off with a Clear-D command. Clear is used as the equivalent of Control as the Dragon has no Control key.

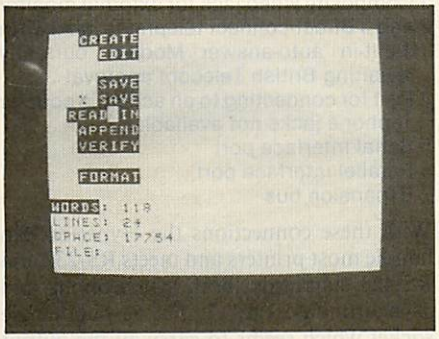
Like WordStar

Deleting characters right of cursor is done by hitting Break, the character left by Clear-@. You are automatically in insert mode — any normal character hit is immediately inserted at the current cursor location. The arrow keys move you around the screen; shifted arrow keys moving you at high speed. It is all quite convenient and fast. In this respect Telewriter is very like WordStar in that it is quick to correct trivial typing mistakes with a minimum number of keystrokes, rather than giving the user wonderful control over block operations for cut-and-paste work.

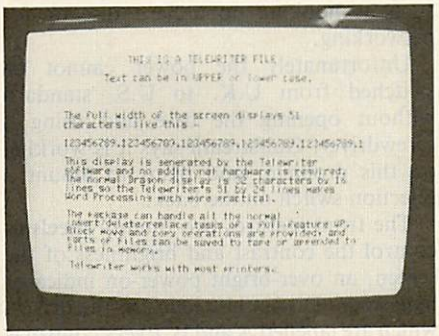
Block operations

Telewriter does have block operations. You first mark a block of text with Clear-B at the beginning and Clear-E at the end. You can then delete the block or move it to the current cursor position. You can return to the main menu at any time with a Clear-M, and selecting the %Save option then allows you to save your marked block to tape if you want.

Telewriter has a good Find-and-Replace function which lets you find any particular string of characters in the text and replace them with another string any number of times. For instance, Clear-G lets you find a pattern and replace it throughout the file.



Telewriter menu.



Typical Telewriter screen.

A superb piece of software.

Returning to the main menu and selecting the Format option brings up Telewriter's second menu, which allows you to specify how you want the document printed. You can print lines up to 127 characters long. The display will still be only 51 characters wide, but when you come to print lines will be output to whatever length you specify.

Some print-time functions are controlled by putting format codes into your text. They work in a similar way to WordStar dot commands: you place an up-arrow symbol ^ in your text followed by the relevant parameter. So to centre text you write Up-arrow H format code, followed by the text you want printed on top of each page, for example

^ H Dragon WP Review

Telewriter is as full a feature word processor as I think you could get on a cassette-based system. The only obvious lack is that you cannot justify text: the right margin cannot be lined up like printed text in this article but must be left ragged, like typewritten material.

Telewriter is the best program I have seen for the Dragon. With a few more like it the Dragon would merit being taken as a more serious machine. Unfortunately the Dragon is an odd machine built aroung the excellent but not very common 6809 processor, and established British software companies writing software for other home machines do not seem to be making the effort to transfer their software across. Sor for instance games from Bug-Byte, Imagine, Psion and Quicksilva are not available for the Dragon.

Only the Tandy Color Computer shares the Dragon's lonely isolation. At the time the Dragon came out the Color Computer already had a substantial following in the U.S., and my major fear for the Dragon is that the availability of excellent but American-oriented software might discourage good British software houses from making the necessary investment to write for the Dragon. The end result could be Dragon users getting the worst of both worlds.

Conclusions

● The Dragon is not the ideal machine to do word processing on; despite its good keyboard its poor display lets it down. That said, Telewriter is an excellent package.

● Textstar is appalling. Obviously you have to make allowances for the price difference, but I feel I could make more allowances were Textstar cheaper.

● In this case you do not get exactly what you pay for — you get more in one case and less in the other.

● Textstar costs £12.95 and is available from PSS, 452 Stoney Stanton Road, Coventry CV6 5DG; telephone (0203) 667556. Telewriter costs £49.95 from Microdeal Ltd, 41 Truro Road, St. Austell, Cornwall PL25 5JE; telephone (0726) 67676.

DYNALOGIC Hyperion

Jack Schofield was first boy on the block with this portable IBM work-alike.

THE SMASH HITS of 1982 in the small business computing world were the Osborne 1 portable and the IBM PC. At least, they were in the U.S. and, perhaps sadly, that's what counts. This year we have therefore been deluged with portable micros and IBM PC look-alikes.

It stands to reason that the secret of success must be to launch a portable IBM PC work-alike, and several companies have done exactly that. Canadian micro company Dynalogic has, it seems, beaten the rest in the race to the market place with its Hyperion model.

The idea of an IBM-type portable certainly makes sense. It enables the new buyer to take advantage of the flood of software the PC is generating. It should also appeal to the person who already has an IBM PC but wants a portable, because that only makes sense if they both run the same programs or, at the very least, can use each other's data. It makes sense for the manufacturers because they can be part of the burgeoning PC market without having to tackle Big Blue head on.

The problem with such "races" is that products may be rushed to market before they are ready. Thankfully this does not appear to be the case with the Hyperion, though there are still a couple of things for the software people to sort out in relation to U.K. IBM compatibility.

At first glance it looks stylish and attractive: it gives you a warm feeling of possessive pride just to have something this smart around. Where the Osborne 1 is workmanlike, the Hyperion is definitely executive, which is just as well as the Hyperion is more than twice the price. Still, if you are bothered about the price you probably can't afford it. The real question is, does it live up to its good looks?

The Hyperion comes in a soft, blue vinyl zip-up bag with a comfortable handle, though unfortunately it lacks a shoulder strap. It is transportable rather than portable, and like the Osborne is said to fit under a standard airline seat. When out of its case, the machine has a hand-sized recess on top which makes it easy to move around. The rigid plastic casing has a stylish rake to it, rather like Apple's Lisa. The front displays a 6.75in. screen plus two 5.25in. floppy-disc drives. A recess under the body holds the detached keyboard.

The mains power input and all the I/O ports are on the back. They are identified with symbols and clearly numbered as follows:

1 Composite video jack for external monitor
2 and 3 Direct-connect telephone jacks with built-in auto-answer Modem, currently awaiting British Telecom approval
4 Port for connecting to an acoustic coupler if phone jacks not available
5 Serial interface port
6 Parallel interface port
7 Expansion bus

With these connections the Hyperion can handle most printers and meets RS-232 and RS-423 standards, both synchronous and asynchronous. Port 7 is a 50-pin female socket which seems to carry all the output lines, and could be used for various things such as hooking up a hard disc or for networking.

Unfortunately the power cannot be switched from U.K. to U.S. standard without opening the case and using a screwdriver. Gulfstream says it is working on this problem, and plans to mount a selection switch on the back.

The front features two thumb-wheels to control the contrast and brightness of the screen, an over-bright power-on indicator light and a Disc in Use light for the drives, which are labelled A and B. Every control is neat and well sited. In addition, the Hyperion is smoothly finished in creamish IBM-coloured leatherette, to complete an attractive package.

The keyboard is somewhat smaller than the IBM version with which it is claimed to be compatible. Typists will be pleased to learn that it does not have the IBM's suprious backslash key between Z and Shift, which messes up the IBM model. It has been moved to the top row between Esc and 1. The Alt key which IBM dumbly sited below Left Shift, has sensibly been moved to the left. The Break key has also been moved to join it.

To narrow the width, the 10 soft function keys, which on the IBM form two ranks down the left, now form two lines along the top of the keyboard. Again this improves usability over the IBM, as the keys now sit under their function labels on the bottom of the screen.

Though the touch of the Hyperion's keys is much inferior to the IBM, the layout is far more suitable for a touch-typist. IBM would do well to look at it, and learn.

The keyboard is flat enough to meet the German Industry standard, with two fold-out feet at the back to raise it to a good typing angle. There is just one thing wrong with it: it is connected at the right-hand end by a strongly coiled cable to the inside left end of the keyboard recess. The keyboard is so light it may be pulled sideways on a shiny desk, and it makes it impossible to use the keyboard on your lap. At least, you need to use one hand to hold it there. The cable is hard wired to the keyboard, so you cannot simply change it.

At a nominal 7in. the screen is larger than the screen of the Osborne 1, and subjectively rather more readable. As the resolution is the same as that of the IBM PC the display is very sharp, and it has an attractive amber colour.

In the 80-character mode, text is quite readable but numbers become harder to distinguish. Horizontal compression of the bit-mapping makes 6, 8 and 9 hard to tell apart. Some of the special characters such

Benchmarks

Comparison of the speed of execution for simple Basic routines running under PC-DOS or MS-DOS. All times are in seconds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
Hyperion	1.2	4.6	10.1	10.5	11.4	20.8	32.4	3.4
IBM PC (retested)	1.2	4.8	11.7	12.2	13.4	23.3	37.4	3.1
Canon AS-100C	1.2	4.9	10.9	11.2	12.3	22.4	34.5	3.7

as the black and white faces, Greek α and the infinity sign become almost unrecognisable. In the 40-character mode, however, readability is outstanding.

The one problem with the screen display is that if not used it turns itself of after only 3 minutes 10 seconds approximately. This may protect the amber phosphor in the long term, but is no good to a pipe smoker or other person whose working schedule includes time-consuming rituals. At least seven minutes thinking time should be allowed before the screen blanks out. There is no way round this problem in PC-DOS, but in Dynalogic's MS-DOS a Mode utility is provided, whereby the screen can be switched on permanently.

Booting up the Hyperion is an interesting experience. Insert the Master User Diskette in drive A and turn the power on. Like the IBM PC, it plays dead for a while before whirring into action. It displays an amber Texas Star then goes into a boot routine. IO-SYS 1.00L is followed by MS-DOS 1.25G. The Hyperion then copies five .Com files, including Format, Chkdsk and Phone, on to dive C:. It then gives the date, checks drives A and B and lists their names, throws up the function-key assignments and waits. It all takes 45 seconds. Drive C: is what Godbout calls drive M:, a portion of RAM set aside to act as a high-speed disc.

The initial five function assignments are Lastln, Disks, Files, Mode, Dir/P, Phone, Edit, MPlan, Xplain and Help. Lastln repeats the last instruction given to MS-DOS. Disks, F2, changes the function assignments to Dos, D-Name, Files, Date, Dir/P, D-Copy, D-Comp, Format, Chkdsk and Help. Pressing F2 again — it mans D-name now — changes them to DOS, Disks, Files, (blank), (blank), A:, B:, C:, (blank) and Rtn. Pressing F3 in the first menu brings up another 10 assignments including Type/P, Eras/P and Rename. And so on . . . The function keys are set up in a series of hierarchies that enable many DOS functions to be accessed via single keystrokes. This is very convenient.

Help brings up a screenful of information on each set of function assignments, which is very useful as the main Hyperion documentation is still IBM size, not portable at all.

The Xplain key gives access to another set of Help files which are saved on the Master Diskette as .Exp files. There are 21 of them, including Copy, Dir, Phone, Type, Softkeys and Hyperion. They can be selected from the menu display by moving the cursor using the arrow keys.

Incidentally, the clock is of the real-time variety with a battery back-up. The date is shown on request and in MS-DOS is permanently displayed between the two groups of five function-key labels. Two advantages of this are that you are spared the MS-DOS request to enter time and date — which are generally ignored — and also, files are labelled with the correct time and date.

The most frequent date on the master diskette is 1-25-83. The universal date on my American IBM PC-DOS system disc version 1.10 is 5-07-82; on my U.K. system disc, also 1.10, it is the same but with a few later additions. Major differences are that the Hyperion disc neither contains Basic nor Basica, nor comes with the Samples set of demonstration routines.

The disc contents as supplied for review did not match the disc label, which suggested In:scribe and In:touch — the Hyperion word-processing and communications programs — were on it. An extra

(continued on next page)

Hyperion

(continued from previous page)

"hand-written" Rev 01 disc did include Multiplan, Basic and Assembler, but not In:scribe or :touch. Multiplan is exactly the same spreadsheet as seen on the Wang, Apple, IBM, DEC Rainbow 100 and numerous other micros.

The Hyperion press release claims it is fully IBM PC compatible, and indeed it has the same operating system and 320K double-sided double-density drives. Nonetheless it did not boot from working copies of the U.K. System Master diskette, only from the American PC-DOS disc or its own. Nor did it prove possible to load the Microsoft Basic or Basica from either IBM disc — the system just crashed.

With Basica loaded from the Hyperion disc it was possible to load and run all the IBM programs available. This makes the Hyperion more compatible than some work-alikes. One reason is that it has the same screen-display characteristics too. It should be possible to run a large proportion of IBM PC packages, with the possible exception of some of those British ones that boot discs automatically.

There is just one bad apple in this particular barrel. That is, the 230V U.K. mains Hyperion still packs an American keyboard, with no £ sign, the @ over the 2 where " should be, and the " next to the Return key. A hunt through the character set confirms it is the American one that is used, with characters 127 and 254 missing for reasons known only to Dynalogic.

If you plan to run American software, this is fine, but IBM(U.K.)'s software is customised for the U.K. keyboard and key positions. I suppose you can learn to press @ when you want ", but it won't be fun. Otherwise, Gulfstream will have to find a way of bypassing the Keybuk file on the IBM system diskette.

Dynalogic's Microsoft 1982 Basic appears to be identical to IBM PC Microsoft Basic. Though it was not possible to test every single command, the only one I could not make work was Circle, but that was my fault: the command worked fine inside the psychedelic Circle program from IBM's American Samples demo.

The Hyperion handles single, double and integer precision in the same way using CSNG, CDBL and CINT. It also follows the IBM PC in the use of Color statements in monochrome. Color 0,7 for example, gives inverse video, and Color 9 gives high-intensity underlined text.

String handling is the same, Locate works the same, and you switch to the 40-character screen by typing either Screen 1 or Width 40, exactly as on the IBM PC. The one-voice music commands seem to be the same, except that the Hyperion plays the tunes faster.

Because of the Hyperion's 4.77MHz clock rate the Basic is slightly faster, as running the trivial Benchmarks thought up by *Kilobaud Microcomputing* magazine shows. As with the IBM, Canon, Orion and other machines reviewed in these pages, the standard Microsoft "bug" is a feature of this Basic. The one-liner

```
10 PRINT 9.9, 990/100
```

gives the result 9.899999, 9.899999, which just serves you right for doing floating-point maths in binary. The program then lists as:

```
10 PRINT 9.899999. 990/100
```

as usual.

Those programming in Basic will find that even while running MS-DOS and with a C: drive in use, there are still 59,866 bytes free to Basic, which is about as much as Microsoft currently allows. The total amount of RAM in the system supplied was 219,888 bytes, of which 39,424 bytes were set aside for drive C:.

The Hyperion came with three IBM-style manuals, a User Guide, a Multiplan Guide and a programmer Guide. Like the DEC Rainbow and IBM examples, they were excellent. In addition, and even more useful, is a slim spiral-bound Setup Guide, which tells you all you need to know to set up and run the machine. It includes a quick-reference guide plus the important specification details, yet is still pocketable. While it is by no means comprehensive, it should provide the average CP/M user with enough back-up to manage a trip out of the office.

Specification

CPU: Intel 8088 running at 4.77MHz; Optional 8087 arithmetic processor
Operating system: MS-DOS, with BOS to follow from Gulfstream
Memory: 256K RAM with 20K video RAM; 8K ROM with diagnostics and I/O routines
Interfaces: serial RS-232C/RS-423; parallel, phone jack and Modem; expansion port; composite video
Features: real-time clock; sound; case

KEYBOARD
Type: 84-key detached with 10-key numeric keypad/cursor-control pad; American layout
Features: auto-repeat on all keys; optional click on keystroke; foldaway feet; stows in main unit for transportation.

DISPLAY
Type: built-in 7in. amber screen with brightness and contrast controls
Displays: 40 or 80 characters by 25 lines up to 250 × 640 pixels; 200 × 640 is provided for IBM PC compatibility

DISCS
Type: two 5.25in. with 320K of storage per drive.

Dimensions: 18.3 by 11.3 by 8.8in.
Weight: 21lb./9.6kg.

Anderson Jacobson's Ajile, identical to the Hyperion, known as the Passport in America.

Conclusions

● The Hyperion is an extremely attractive portable and in advertising/marketing terms certainly rates as "sexy".

● It is light enough and rugged enough to be moved about, though bear in mind you need mains power to run it. One drawback is that the power supply is U.K. and not externally switchable, but Gulfstream may solve this problem.

● It is sufficiently IBM PC compatible to foster expectations of a good software base rapidly becoming available.

● The screen and keyboard are well designed and with a minor alteration to each would be excellent.

● It is not cheap, but it seems good value for money—especially for anyone who really needs a compact or transportable micro, or who has regular contact with real IBM PCs.

● The Hyperion is manufactured in Canada by Dynalogic Info-Tech, and distributed in the U.K. by Gulfstream Computer Products, Unit 3A, Tunnel Estate, 726 London Road, West Thurrock, Grays, Essex RM16 1LS; telephone (04026) 4926. Both companies are subsidiaries of the $50 million Bytec Management Corporation of Ottowa.

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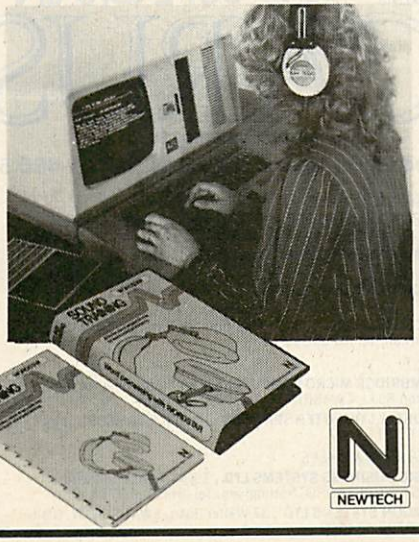

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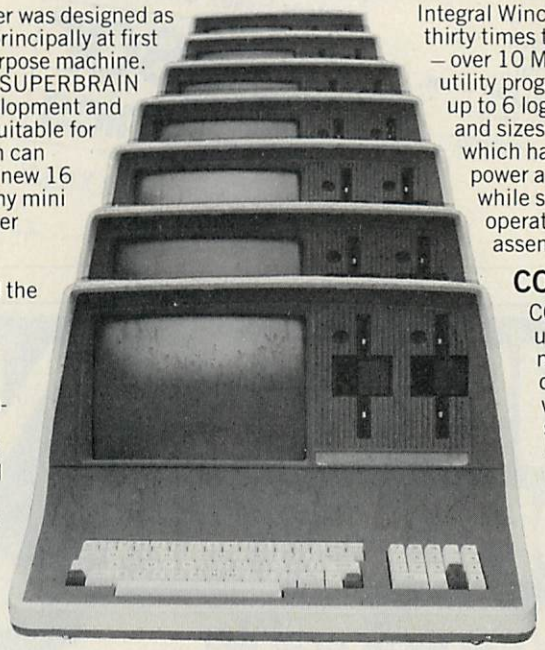

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BBC spreadsheets

Matching software to your requirements is always important. John Harris takes three Calcs for the BBC and weighs up their capabilities.

THE BBC MICRO is generating some beautiful software products and these may well soon set the standard for the rest of the micro market. The hardware is modern, and with extensions will remain so for longer than the competition. And not only is the hardware cost right, but the prices charged for available non-game software are lower by factors of five to 10 compared with what has been available on older micros and on CP/M.

The three spreadsheet programs selected for review are low, mid- and high-price products in current BBC software terms. They vary in their capabilities, which need to be carefully matched to individual requirements before the decision is made to choose one in preference to another.

The cheapest of the BBC Calcs is undoubtedly that from Micro-Aid of Cornwall. It combines the functions of an index-card data manager with a very limited set of arithmetic facilities, and as such can emulate a subset of spreadsheet functions. Whether it meets your specific needs can only be for you to decide, but if it does it must be among the least expensive pieces of useful software you will ever buy.

Operationally it is the least convenient of the three, requiring explicit key depressions to allow individual field modification, which is a bind if you want to vary very many of them. The internal terminology refers to records and columns instead of the more conventional rows and columns, which is a consequence of the data-manager aspect of the program, but the effect is no different. Headings are limited to a single column or row, as are the automatically recalculated Total fields.

All the recognisable spreadsheet elements are present, such as cursor movement between cells, direct addressing, arithmetic manipulation using any Evalable equation across a restricted range of source cells into a nominated cell. What is missing is the ability to link permanently such equations to the destination cells; only resulting values are carried through to the Saved file.

This restriction bars the program from membership of the spreadsheet family proper but, as with all software products, if it can do the job you require it for then you have found a candidate for selection. If not, then do not waste any more time — move on.

Beebcalc from Gemini Marketing allows full spreadsheet manipulations across a maximum addressable array of 26 columns by 50 rows. Don't think you can populate them all, of course. At some point available memory will be filled and the operating system will intervene with a No Room interrupt, which is frustratingly final.

To give an example of what will fit into a Model B with disc-filing system a start-up projection for a knitting shop is shown in figure 1. As in any such emulation the projection is broken down into its most elementary operations, in this case stitches. A "nominal" stitch defined as that for plain hand knitting, and all other operations, such as machine knitting, are costed on a *pro rata* basis. The intention is that the chargeable staff time is invoiced at a constant hourly rate, regardless of the particular activity involved.

Overheads are entered along with salaries and initial investment costs. The start-up rate in terms of regular customers is

(continued on next page)

Table 1. Memo-Calc instruction set.

Option 1	2	3	Meaning
1			**Create new file**
2			**Search for record**
	K		named record
	N		by number
3			**Column search**
	A		all
	E		numeric equal
	L		numeric less
	G		numeric greater
4			**File manipulation**
cursor keys			active
	/		fast jump
	A		add a record
	C		change a record
	H		modify column heads
	K		change key field
	M		modify data
	R		view or print record
	F		view or print file
	S		sorts on column
	@		calculations
		C	total columns
		R	total records
		1	on cell contents
		2	on two cells*
		X	on range of cells*
		Y	as X* **
5			**Save file**
6			**Load data**
7			**Print complete file**
8			**Exit program**

*result stored in nominated cell
**nominated cell may exceed current file bounds

Table 2. Beebcalc instruction set.

Option 1	2	3	Meaning
cursor keys			**Active**
numerics			**Enter value**
"literal"			**Enter text**
/			**Enter command mode**
	B		blank cells
		G	global
		E	entry
		C	column
		R	row
	C		calculate
	D		change display format
		L	left
		R	right
		I	integer
			sterling
	E		extend or delete table
	F		formula entry
	G		jump to any cell
	P		print
		T	table
		D	data
	R		replicate
		A	absolute
		R	relative
	S		save data
		D	disc
		T	tape
	T		toggle on/off
		A	auto recalculate
		O	order RC or CR
	W		column-width adjustment
	*		exit Command mode

BBC spreadsheets

(continued from previous page)

decided by informed guesswork, and from that point on all figures are derived automatically by the in-built relationships between the base data fields. Both print modes, Table and Data, are demonstrated, showing the degree to which the data elements may be interlocked and generated.

A model of this complexity is quite capable of showing the effect of Low/High variations on each set-up parameter, allowing isolation of the critical variables from those whose variation has little effect on the profit line. It is simple from that point to plot a profit against charge against workload contour map, for example, which describes the result in terms of the two most critical elements for a business of a given size.

Operation of Beebcalc is simple and convenient so long as you remember to toggle off the automatic recalculation at the beginning if you have several fields to set up or modify. Calculation of the example took less than a minute, and was the only operation requiring a pause in program use. The example was designed and coded in about three hours.

Some minor details within the program handling are inconvenient. Formula editing is non-existent, which is unnecessarily harsh if all that needs to be changed in a cell equation is a single character. The formula replication allows relative addressing but the algorithm employed in deciding what is relative and what is fixed is over-simplistic. The result is that very few sensible replications can be made, and most formulae in the example were eventually keyed in full. Finally, no attempt is made to recover from a full memory and to retrieve the existing data.

Ultracalc was designed and coded by Topexpress of Cambridge. Originally intended for use by Topexpress itself, it is now in the process of being marketed by BBC Publications. On discovering that it is the spreadsheet demonstrated all those months ago on the BBC TV series by Ian Macnault-Davis one might wonder quite what has taken them so long. The program comes on ROM, and is by far the best documented of the existing BBC spreadsheets; the manual was written by the same team at Information Transfer that built the View manual for Acornsoft.

A maximum array of 63 columns over 255 rows gives Ultracalc a full spreadsheet range. Headings may be defined to any depth on the top and left of the sheet, so the first page displayed could, for example, contain a label index into the body of the analysis with appropriate text descriptions.

The ability to partition the sheet and locate the desired information without otherwise remembering or looking up the cell address makes manageable what would otherwise be a very unwieldy mass of data. The ability to colour each individual cell from the range of eight mode 7 foreground and background colours further simplifies recognition of specific areas of the analysis.

Considerable power

Ultracalc is able to save and load not only the model but also sections of data from a model, thereby overlapping and merging results from one analysis into another. Careful tailoring of addresses is required for this technique to be used to its full potential, but the power in a suite of associated models is considerable.

A full range of editing facilities has been built into the data and formula-entry procedure with the result that changes to a given model are easy to implement. At no point does the program require more keystrokes than seem necessary to accomplish a given function. Clearly, considerable care has been taken in designing the user interface.

The difference between one spreadsheet and another priced 10 or 20 times as high is no reflection on the utility of the programs for a given user. Somewhere in the market place it may be the case that you get what you pay for, but that has never been true of software, from mainframe tailored systems down.

The concept of buying the most expensive to get the quality goods is pretty shaky at the best of times. The only way to choose between one product and another is to know your requirements beforehand and to check the market for the best match, adjusting requirements in the light of available facilities and costs only at the end of the exercise.

Table 3. Ultracalc instruction set.

Option 1	2	3	Meaning
Cursor keys			**Active for cell location**
Shifted cursor keys			**Active paging**
Ctrl-A			**Recalculate**
f8			**Move input cursor left one character**
f9			**Move input cursor right one character**
Shift-Copy			**Duplicate current cell entry to input**
Delete			**Delete character at input cursor**
Copy			**Put current cell address to input**
Return			**Interpret input prefix**
	/		input is command
		= <entry>	fast jump
		A	Tab direction; press cursor key
		B	delete cell contents
		DC	delete column
		DR	delete row
		F n	format to n decimal places
		FA <area>	copy format throughout area
		FL	left justify current cell entry
		FR	right justify current cell entry
		G <entry>	as = <entry>
		H	protect current cell
		HX	cancel protection
		IC	insert column
		IR	insert row
		HA <area>	copy protection throughout area
		L	load data from file created by S
		M	toggle autorecalculation
		O <area>	print the sheet parameters within area
		P <area>	print the sheet within area
		Q	quit and restart
		R <area> <area>	replicate
		/ <area>	as R from a single cell
		S	save data to file
		T	fix rows and columns top and left of cell
		TX	unfix rows and columns top and left of cell
		W n	change width of column in range 0 to 39
		WA <area>	change width to that of current cell
		Z	toggle scale display
		—	toggle Commercial/Scientific
		~	make negatives red
		*	pass rest of line to OS as command
	+		input is value
	"		input is label
	other		input is evaluated as value or label
Esc			**Clear input and re-enter**
Break			**Hardware reset**
Tab			**As Return with move; see /A**
f0 to f7			**background colour change**
Shifted f0 to f7			**character colour change**

Suppliers and prices

	Supplier	Format	Price
Memo-Calc	Micro-Aid	Cassette	£7.95
		Manual	+£2
		Disc	+£1.50
Beebcalc	Gemini Marketing	Cassette	£19.95
		Disc 40	+£4
		Disc 80	+£5
Ultracalc	BBC Publications	ROM	£50

Figure 1. Knitting shop on Beebcalc.

```
CELL A45: TEXT="knitters' payroll"
CELL B45: FORM=B23*B35
CELL C45: FORM=B23*C35
CELL D45: FORM=B23*D35
CELL E45: FORM=B23*E35
CELL F45: FORM=B23*F35
CELL G45: FORM=B23*G35
CELL H45: FORM=B23*H35
CELL I45: FORM=B23*I35
CELL A46: TEXT="PAYE overheads"
CELL B46: FORM=B24*(B45+B22/12)
CELL C46: FORM=B24*(C45+B22/12)
CELL D46: FORM=B24*(D45+B22/12)
CELL E46: FORM=B24*(E45+B22/12)
CELL F46: FORM=B24*(F45+B22/12)
CELL G46: FORM=B24*(G45+B22/12)
CELL H46: FORM=B24*(H45+B22/12)
CELL I46: FORM=B24*(I45+B22/12)
CELL A47: TEXT="costs total"
CELL B47: FORM=B44+B45+B46
CELL C47: FORM=C44+C45+C46
CELL D47: FORM=D44+D45+D46
CELL E47: FORM=E44+E45+E46
CELL F47: FORM=F44+F45+F46
CELL G47: FORM=G44+G45+G46
CELL H47: FORM=H44+H45+H46
CELL I47: FORM=I44+I45+I46
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CELL B48: FORM=B43-B47
CELL C48: FORM=C43-C47
CELL D48: FORM=D43-D47
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CELL G48: FORM=G43-G47
CELL H48: FORM=H43-H47
CELL I48: FORM=I43-I47
CELL A50: TEXT="cumulative profit"
CELL B50: FORM=B48-B26
CELL C50: FORM=B50+C48
CELL D50: FORM=C50+D48
CELL E50: FORM=D50+E48
CELL F50: FORM=E50+F48
CELL G50: FORM=F50+G48
CELL H50: FORM=G50+H48
CELL I50: FORM=I48*12

CELL B1: VALUE=7.5E-4
CELL A2: TEXT="plain hand knitting"
CELL B2: FORM=D1/C2
CELL C2: VALUE=1
CELL D2: FORM=B2*C2
CELL A3: TEXT="fancy hand knitting"
CELL B3: FORM=D1/C3
CELL C3: VALUE=0.8
CELL D3: FORM=B3*C3
CELL A4: TEXT="designer set machine knit"
CELL B4: FORM=D1/C4
CELL C4: VALUE=5
CELL D4: FORM=B4*C4
CELL A5: TEXT="preset program machine knit"
CELL B5: FORM=D1/C5
CELL C5: VALUE=20
CELL D5: FORM=B5*C5
CELL A6: TEXT="batch retention per month"
CELL B6: VALUE=2.25E-4
CELL A7: TEXT="proportion plain hand knit"
CELL B7: VALUE=0.25
CELL A8: TEXT="proportion fancy hand knit"
CELL B8: VALUE=0.25
CELL A9: TEXT="proportion set machine knit"
CELL B9: VALUE=0.15
CELL A10: TEXT="proportion preset machine knit"
CELL B10: VALUE=0.35
CELL A11: TEXT="batch storage customer hand"
CELL B11: VALUE=0.25
CELL A12: TEXT="batch storage customer machine"
CELL B12: VALUE=0.1
CELL C12: FORM=B7*B11+B8*B12
CELL A13: TEXT="batch storage one-off hand"
CELL B13: VALUE=5E-2
CELL C13: FORM=D2*B7+D3*B8+D4*B9+D5*B10
CELL A14: TEXT="batch storage one-off machine"
CELL B14: VALUE=1E-2
CELL C14: FORM=B7*B13+B8*B14
CELL A15: TEXT="new customers per month"
CELL B15: VALUE=14
```

								7.5E-4
plain hand knitting	7.5E-4		1					7.5E-4
fancy hand knitting	9.375E-4		0.8					7.5E-4
designer set machine knit	1.5E-4		5					7.5E-4
preset program machine knit	3.75E-5		20					7.5E-4
batch retention per month	2.25E-4							
proportion plain hand knit	0.25							
proportion fancy hand knit	0.25							
proportion set machine knit	0.15							
proportion preset machine knit	0.35							
batch storage customer hand	0.25							
batch storage customer machine	0.1	6.75E-2						
batch storage one-off hand	5E-2	7.5E-4						
batch storage one-off machine	1E-2	1.5E-2						
new customers per month	14							
customer loss rate per month	0.2							
one-offs per month	40							
customer workload per month	100000							
one-offs workload per month	40000							
workstation cost per month	125							
rent rates and bills	2575							
administrator's salary	5750	694						
knitter's pay per month	375							
NI and employer contribution	0.2							
workload per knitter month	1300000							
initial costs	1650							

	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	STEADY
number of customers	5	15	26	35	42	47	52	70
customer workload total	500000	1500000	2600000	3480000	4184000	4747200	5197760	7000000
one-offs workload total	1600000	1600000	1600000	1600000	1600000	1600000	1600000	1600000
batch types current	53	130	235	362	507	665	835	10000
workstations	2	3	4	4	5	5	6	7
customers knitting receipts	0	375	1125	1950	2610	3138	3560	5250
customers storage receipts	0	10	30	61	98	143	192	400
one-offs knitting receipts	1200	1200	1200	1200	1200	1200	1200	1200
one-offs storage receipts	5	11	16	22	22	27	32	125
income total	1205	1596	2371	3233	3930	4508	4984	6975
overheads	944	1069	1194	1194	1319	1319	1444	1569
knitters' payroll	750	1125	1500	1500	1875	1875	2250	2625
PAYE overheads	246	321	396	396	471	471	546	621
costs total	1940	2515	3090	3090	3665	3665	4240	4815
profit	-734	-919	-719	143	265	844	745	2160
cumulative profit	-2384	-3303	-4022	-3879	-3614	-2770	-2025	25925

Calcstar and Plannercalc

Mike Lewis compares two successful spreadsheet packages

OF THE SCORE or so spreadsheet packages available for CP/M-based micros Comshare's Plannercalc and Micropro's Calcstar are among the most successful. Plannercalc is a low-cost no-frills program aimed at the occasional user. Calcstar is far more sophisticated and can meet some very demanding requirements.

To evaluate these two packages I tried them on a very simple problem — a profit analysis of the sort that might be used by a wholesaler. I wanted to enter a list of the products normally held in stock together with their cost prices, selling prices and the volume of average monthly sales. I expected the software to tell me how much gross profit I am earning on each product.

The calculations involved are trivial: subtract cost price from selling price to get profit-per-unit then multiply this by volume of sales to get total profit. Nevertheless, this is a problem that is highly suitable for a spreadsheet package especially when a large number of items are involved. You realise its value every time a price changes and you can see immediately the effect on your profitability.

If you are a WordStar user the Calcstar screen will look familiar. Micropro has followed its usual practice of placing a very brief command menu at the top of the screen, which you can switch on and off at will. Below this is a window into the data, which can scroll in four directions.

The window shows part of the worksheet, which is simply a grid made up of rows and columns. The rows are numbered consecutively and the columns are identified by letters A, B, C up to DW. Any cell can be referenced by a simple co-ordinate, such as A2 or D5.

Entering the data for my profit analysis was simplicity itself. You place the cursor, actually a pair of reversed angle brackets, into the appropriate cell then type the required value. You can move the cursor by using a set of WordStar-like control keys. Alternatively you can press the tab key then type the cell's co-ordinates.

It took only a few moments to type my stock numbers, item descriptions, pack types, prices and volumes. A cell can contain either text or figures and the two might be freely mixed. You can make the text left-justified, right-justified or centred.

The next step was to tell Calcstar to work out the figures for unit profit margin. I moved the cursor to the first cell in the margin column, cell E3, and typed the formula: D3 – C3, selling price minus cost price. The margin figure for the first item appered in the cell. I then used the Copy command to reproduce this formula in every cell in the column, which puts the margin figure for every item in the inventory.

To execute a Calcstar command such as Copy you enter a semicolon followed by the command's initial letter. The program prompts for any further details, such as the co-ordinates of the cells to be copied. In this case I typed:

; C E3 E4> E8 R

It may not be particularly readable but at least the typing is kept to a minimum.

The R in this command means that the co-ordinates in the formula being copied are relative to the original location. Calcstar automatically adjusts the co-ordinates so that they always apply to the correct row.

The same technique produced the figures for overall profit except that here the formula was E3*F3, margin times average sales. Finally I obtained the total profit for all items by moving the cursor to cell H10 and entering:

SUM(H3>H8)

Sum is one of several arithmetic functions that you can use in formulae. Others are: Max; Min; Avg, mean average; Sqrt, square root; and Cnt, count of the number of items in a list. These are in addition to the normal arithmetic operators like plus, minus and multiply.

A useful Calcstar feature is that you can evaluate formulae completely independently of the spreadsheet. If you had a sudden desire to know the square root of 127 you could type SQRT(127) followed by a question mark, and the answer would appear at the foot of the screen.

One of the commonest uses of this type of model is to see what happens when things change. Suppose your selling prices

Figure 1. Calcstar screen layout.

```
-Cursor Movement- |          -Commands-  ; folowed by          | -Misc-
 <CR> Right       |A Auto    F Format  L Load  R Recalc * Extend|@ Curs Pos
^S Left  ^D Right |C Copy    G Goto    M Merge S Save    = Lock  |? Evaluate
^E Up    ^X Down  |D Delete  H Help    O Order W What    ? Space |^ data Togl
^Z Col A next row |E Edge    I Insert  P Print       <TAB> Goto  |<ESC>Cancel
Col> |A         |B             |C      |D          |E        |F       |G
Row+-------------------------------------------------------------------------
  1:>Stock No < Description    Pack          C.P.      S.P.  Margin      Av. S
  2:
  3: A1345      Manilla 3 x 6  Box           4.50      5.75    1.25
  4: A2376      White 3 x 6    Box           4.95      6.25    1.30
  5: A3541      DL Window      Band          5.55      7.00    1.45
  6: A5622      DL Self-Seal   Band          5.90      7.45    1.55
  7: A5988      Cartridge 9x6  Cell          6.20      7.90    1.70
  8: A6152      Manilla C4     Box           7.45      8.45    1.00
  9:
 10:                                                      Total Profit All L
  +-------------------------------------------------------------------------
[ENVSTOCK]    cursor: A1      current: A1     L-R

current||       type: text, left justified
data   ||   contents: 'Stock No'
              edit:
```

go up but your sales volumes go down. You can enter the new figures then use the Calcstar Recalculate command, Enter ;R. All the formulae associated with the model are re-evaluated and you can see your new profit figures in an instant.

Naturally it is important to be able to save the spreadsheet on disc. The Calcstar Save command, ;S, writes the entire model to disc — text, calculated values and formulae. You can specify a password to protect confidential work.

The Save command also allows you to store a sub-array, that is any rectangular section of the grid, not necessarily whole rows or columns. This ability to deal with sub-arrays is one of Calcstar's greatest strengths. You can use it to join two worksheets together, to superimpose one set of data on to another, or to print a report made up of different parts of one or several models.

Having saved my Calcstar model I put it to one side and turned to Plannercalc. The two packages were at first sight very similar. However, I found Plannercalc much more difficult for setting up my profit analysis, and I quickly came up against some of its limitations.

The first problem with Plannercalc is that you cannot enter text into the spreadsheet. So I had to leave out all my descriptions and pack types. The best you can have is a 12-character label for each row and column. The label must contain capital letters or digits only without any spaces, though you may use apostrophes instead, which does nothing to improve readability.

Entering these labels is rather long-winded as is entering values and formulae. I had to set up my first stock item as follows:

LINE 1 A1345 = 4.50, 5.75, , 230,

and so on for each product in the inventory. To specify the formula for profit margin you type:

COLUMN 3 MARGIN = COLUMN 2 - COLUMN 1

Even underlining requires a command like:

UNDERLINE LINE 6

whereas in Calcstar you simply move the cursor to the appropriate cell and underline it.

The Plannercalc spreadsheet does not alter during the typing of these commands. You must first type Execute, at which point the formulae are evaluated and the values and labels are displayed in the grid.

Although somewhat tedious, the Plannercalc approach has an important advantage — it is much easier to follow the logic of the model. You can get a printout of all the commands and because they are in a language that loosely resembles English it is quite simple to check them.

I later discovered that you can get away with typing the first three letters only of each command, which saves a lot of time. Unfortunately, this fact is given the briefest possible mention on the manual and you can easily miss it.

The commands themselves are adequate for most simple models, as are the operators and functions that can be used in formulae. Apart from the usual arithmetic operations you can raise values to powers and determine natural logarithms and exponents. As in Calcstar there are functions for extracting minima, maxima and mean averages. There is also a Grow By function that is handy for compound interest calculations.

The weakness of all these features is that they can only operate on entire rows or columns. By contrast Calcstar works quite happily with individual cells and groups of cells, and it allows you to mix formulae and data types within a column or row. Plannercalc is much more restrictive and I feel that this is a major drawback of what would otherwise be a very usable system.

Another advantage of Calcstar over Plannercalc lies in its ability to link with other software systems, which it does in two ways. Firstly, it can print a spreadsheet, or part of one, to a disc file. The file is a standard ASCII text file that can be processed by Wordstar or any similar word processor or text editor.

The other method is to convert the Calcstar spreadsheet into a comma-delimited file with one record for each row and one field for each cell. This is the file format used by other Micropro products, such as Datastar, Mailmerge and Supersort. It can also be read by dBase II and Microsoft Basic.

But one area in which Plannercalc scores is its extensive Help system. It is almost a separate package with its own menu and over 80 screens of narrative and

(continued on next page)

	Calcstar	Plannercalc
Maximum theoretical matrix size (rows × cols)	255 × 277	512 × 128
Typical window size	10 × 7 with command menu; 15 × 7 without	15 × 6
Typical number of cells	500	700
Maximum column width	63 characters	30 characters
Accuracy of calculations	14 digits	28 digits
Text allowed in matrix?	yes	no
Row and column headings	no restrictions	12 characters
Comments in formulae?	yes	no
Password protection	for individual models	none
Can handle sections of spreadsheet?	yes	no
Spreadsheets can be merged?	yes	no
Page breaks can be specified in printouts?	yes	no
Reports can be written to disc for subsequent word processing?	yes	no
Data can be passed to other systems?	yes	no
Split screens	limited	extensive
Help screens	two narrative screens plus a command menu	extensive help facilities with over 80 screens
Specialist applications	linear regression	discounted cash flow

Figure 2. Plannercalc screen layout.

```
MODEL NAME: TOPLEDGE          MEMORY=23        SIZE=5          DEFER

                                  ENTER COMMAND

                    QTR'1       QTR'2       QTR'3       QTR'4       YEAR
 1.0 SALES        10175.0     14683.0     15898.0     17011.0     57767.0
 2.0 COGS          6975.0      7095.0      9876.0     11735.0     35681.0
 3.0 ADMIN         2000.0      2000.0      2000.0      2000.0      2000.0
 4.0 PRE'TAX       1200.0      5588.0      4022.0      3276.0     14086.0
 5.0 TAXES          576.0      2682.2      1930.6      1572.5      6761.3
 6.0 AFT'TAX        624.0      2905.8      2091.4      1703.5      7324.7
 7.0 DEPREC         500.0       550.0       600.0       650.0      2300.0
 8.0 CASHFLOW      1124.0      3455.8      2691.4      2353.5      9624.7
 9.0 CAP'INVEST    2000.0      2200.0      1610.0      1900.0      7710.0
10.0 NET'FLOW      -876.0      1255.8      1081.4      453.5       1914.7
11.0 CUM'FLOW      -876.0       379.8      1461.2      1914.7      2879.7

--------------------------------------------------------------------------------
?
```

Calcstar and Plannercalc

(continued from previous page)

operating instructions. It certainly makes Calcstar's two screenfuls of Help look pitiful.

Another plus for Plannercalc is its ability to handle split screens. It is useful for working on two areas of the spreadsheet at the same time, without having to constantly scroll between them. You can specify either a horizontal or vertical split at any column or row, but not both at the same time. The display on one side of the split stays constant while the other side scrolls. Calcstar has a similar facility but it is more limited.

There are more specialist uses of spreadsheets. One widely-used modelling technique is linear regression which attempts to predict values of a variable according to known values of a different type of variable. Calcstar is particularly strong in this area.

Say you are an ice-cream vendor and you have noticed that your daily sales are related to the temperature at midday. You could enter your sales for the last 10 days into Calcstar along with the corresponding temperatures. The Calcstar Regr function would then determine the linear equation that best fits these values.

Three more Calcstar functions would then be available for answering vital questions: Proj for "What sales can I expect for a given temperature?"; Depd for "What must the temperature be to achieve a given level of sales?"; and Slope to find out "How many extra sales can I expect for each rise in temperature of one degree?"

Another popular technique is discounted cash flow. It is used to compare the returns on different types of investment by giving a higher weighting to returns that come in earlier. The principle is that £1 million next year is better than £1 million in 10 years time.

Plannercalc has a neat way of doing this type of calculation. Its NPV function determines the net present value of a series of expenditures against a series of returns for a given discount rate. Of course, you could do the same calculations in Calcstar but not quite as easily.

Unfortunately the manuals of both packages leave a lot to be desired. Both are badly organised and difficult to follow. The Calcstar manual has plenty of examples but it is useless for quick reference. The Plannercalc manual is printed in very small type and the index is skimpy, to say the least.

Given its sophistication plus the marketing skills of Micropro it is not hard to see why Calcstar has been so successful. The package is widely available from computer shops and software vendors, and although the price varies you could expect to pay around £120.

The early success of Plannercalc was due almost entirely to its low price. The package originally cost £39, so it was cheaper for a company to buy it unseen than to send a highly-paid executive to a demonstration. Comshare's strategy was to start the customer on Plannercalc, then to allow him to trade it in for the more powerful Masterplanner which costs £245.

Today Plannerclac costs £85. You can buy it from dealers throughout the country or direct from Comshare at £99.50 which includes postage and VAT. The Masterplanner trade-in offer was terminated in February.

Conclusions

● Both Calcstar and Plannercalc may be used for a wide range of spreadsheet applications, but Calcstar is by far the more powerful of the two. It is flexible, easy to use and likely to satisfy the most demanding user.

● A major advantage of Calcstar is that data can be exchanged with many other application packages, including products in the Micropro range such as WordStar, Datastar and Supersort.

● Calcstar also allows you to join worksheets together or to prepare reports made up from parts of one or more models.

● Plannercalc is much more limited and lacks flexibility. It is adequate for occasional use, and it would provide a useful low-cost introduction to modelling for the first-time user. But you can expect to outgrow it quickly.

● Plannercalc commands are generally more long-winded to use than Calcstar's. But the more limited package — Plannercalc — does have the better help facility.

● The standard of documentation of both packages is poor.

Figure 3. Calcstar report.

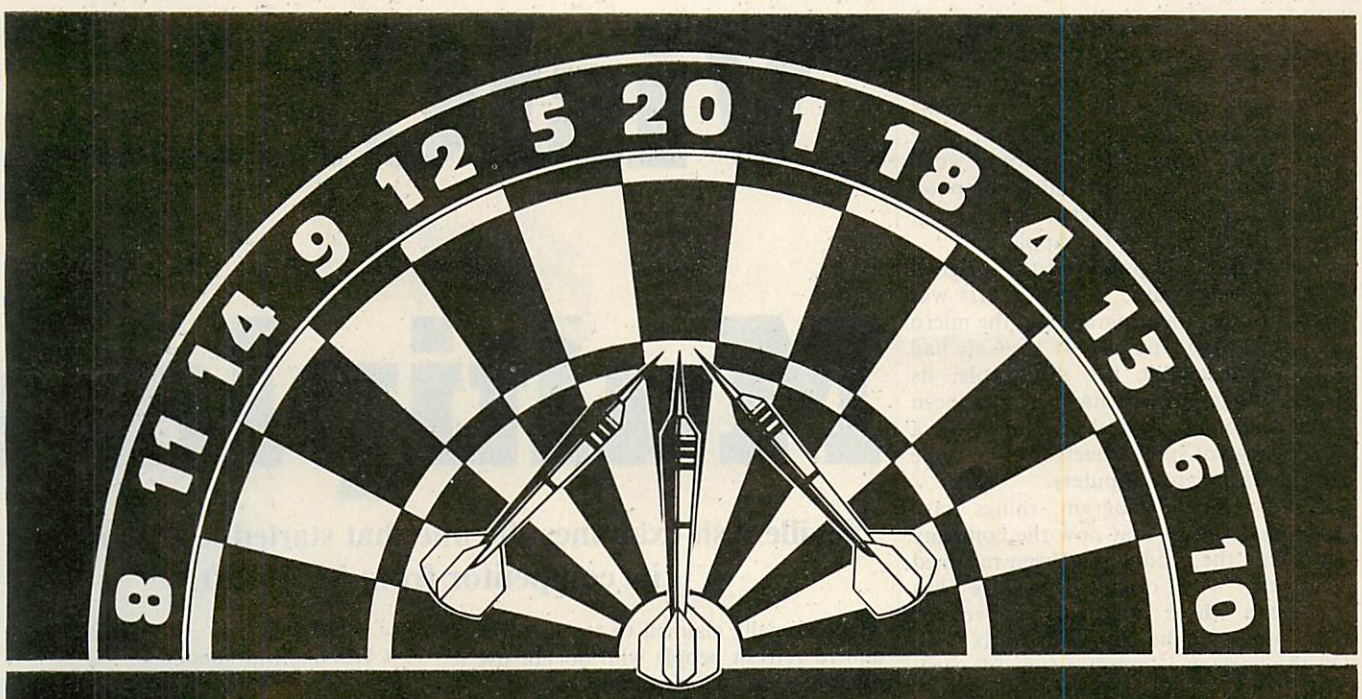
Envelope Stock List

Stock No	Description	Pack	C.P.	S.P.	Margin	Av. Sale	Profit
A1345	Manilla 3 × 6	Box	4.50	5.75	1.25	230	28.75
A2376	White 3 × 6	Box	4.95	6.25	1.30	320	416.00
A3541	DL Window	Band	5.55	7.00	1.45	145	210.25
A5622	DL Self-Seal	Band	5.90	7.45	1.55	220	341.00
A5988	Cartridge 9 × 6	Cell	6.20	7.90	1.70	35	59.50
A6152	Manilla C4	Box	7.45	8.45	1.00	82	82.00

Total profit All Lines 1137.50

Figure 4. Logic for a typical Plannercalc model.

```
DATE: 1ST JUNE 1983
HEADING 1 = THE TOP LEDGE COMPANY INC
HEADING 2 = CASH FLOW STATEMENT
LINE 1 SALES = 10175,14683,15898,17011,
LINE 2 COGS = 6975,7095,9876,11735,
LINE 3 ADMIN = 2000 FOR 4
UNDERLINE ADMIN
LINE 4 PRE'TAX = SALES - COGS - ADMIN
LINE 5 TAXES = GREATER OF 0 OR PRE'TAX * .48
UNDERLINE TAXES
LINE 6 AFT'TAX = PRE'TAX - TAXES
LINE 7 DEPREC = 500,550,600,650,
LINE 8 CASHFLOW = AFT'TAX + DEPREC
LINE 9 CAP'INVEST = 2000,2200,1610,1900,
UNDERLINE CAP'INVEST
LINE 10 NET'FLOW = CASHFLOW - CAP'INVEST
LINE CUM'FLOW = CUM NET'FLOW
COLUMN 1 QTR'1
COLUMN 2 QTR'2
COLUMN 3 QTR'3
COLUMN 4 QTR'4
COLUMN 5 YEAR = SUM OF QTR'1 THRU QTR'4
SIZE = 5
WIDTH = 10
SIGNIFICANCE = 6
```



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VisiCalc and Multiplan

Neville Ash examines the one that started it all alongside its competitor from Microsoft.

IF YOU BUY a business microcomputer one of the programs supplied with it will be an electronics spreadsheet. If no spreadsheet is available that computer is crossed off your shopping list. This program, more than any other apart from word processing, has made the microcomputer come of age. And the microcomputer that started things off was the Apple.

Not that Apple produced this original electronic worksheet. Software Arts was first to supply the program and the micro chosen was the Apple II. If VisiCalc had not been available for the Apple, its dramatic sales growth may well have been stunted. Today, VisiCalc is but one of a whole range of spreadsheets for the Apple and similar microcomputers.

From a single program, things have developed so fast that now the company producing the product has been renamed VisiCorp. The original package has become a whole range of inter-related programs with the common prefix Visi. On the horizon is another leap forward, VisiOn, which could have the same impact as the Apple Lisa, launched earlier this year and soon to be available in small quantities.

For all its sophistication, VisiCalc has never been easy to use. I was introduced to it over a year ago and until recently didn't use it. It is not that there is anything wrong with the product, rather that the demonstration didn't really make things clear enough.

A year later I was offered the opportunity of examining the newest electronic worksheet, Multiplan, and rather than look at it in isolation decided to compare its approach and features with VisiCalc.

In the short time I didn't get on with VisiCalc things had changed dramatically. The product was being constantly improved and a whole sub-industry appeared. Books appeared telling you how to get the best from VisiCalc, and special courses appeared on mastering it. Companies started to produce hardware and software to extend VisiCalc's possibilities. There was a course supplied on floppy discs under the name of Cdex — which actually claimed to teach VisiCalc and to refresh people who do not use it every day. So an initial comparison of two spreadsheets became a three-way operation: VisiCalc, VisiCalc plus Cdex, and Multiplan.

VisiCalc and Multiplan have one thing in common — they work. But how they work and whether they are the product you have been looking for is another matter. As spreadsheets they offer a wide range of features, some so specialised to have only a limited appeal to many readers. Even so, how you approach them is important.

Where these products are available for 16-bit micros there is provision for having a far larger working area. In the case of VisiCalc, this can already be done with the Apple II using products produced by independent hardware and software companies.

Instead of listing features shared by VisiCalc and Multiplan, I have concentrated on the features which are exclusive to each of the programs, features which would be desirable if added to the other package.

Cdex and VisiCalc both work on the normal 40-column setting of the Apple II. Multiplan offers the choice of using a 40- or 80-column display, but must first be booted up in the 40-column mode. The package of Cdex indicates that it can be used with 16-sector disc drives and 40 or 80 columns, but the program only worked on 40 columns. With an 80-column Videx card plugged in, the red light stayed on and the disc drive just continued to whirr.

Cdex consists of a manual and three 5.25in. floppy discs. After booting up disc 1 you must indicate whether an Apple II+ or IIe is being used, mainly because of the extra function keys fitted to the IIe.

The main menu for disc 1 offers the following options:

A — How to use this program.
B — Key terms you will need to know.
C — Moving the cursor on the worksheet.
D — Labelling columns and rows.
E — Entering values and formulae.
F — Working with functions.

In each case the explanation given is simple, easy to understand and finishes with a test to make sure you have understood what has been explained. If the answer is correct the musical reply and comments on the screen indicate success. However, in each case there is the option of leaving the program, skipping a question, getting some hints and returning to the menu. You have the choice of completing as many or as few questions as you wish depending on your progress.

Disc 2 follows the same system and has five choices on the menu:

A — Using commands.
B — Saving/retrieving your work.
C — Printing your work.
D — Replicating the concept.
E — Replicating the process.

To learn about Visicalc, it is best to work through disc 1 and then disc 2. If someone who has a basic understanding needs an update, then this is covered on disc 3, which has six options plus return to VisiCalc:

A — Using commands.
B — Using built-in functions.
C — Key worksheet terms.
D — Entering labels.
E — Entering values.
F — Entering formulae.
V — Return to VisiCalc.

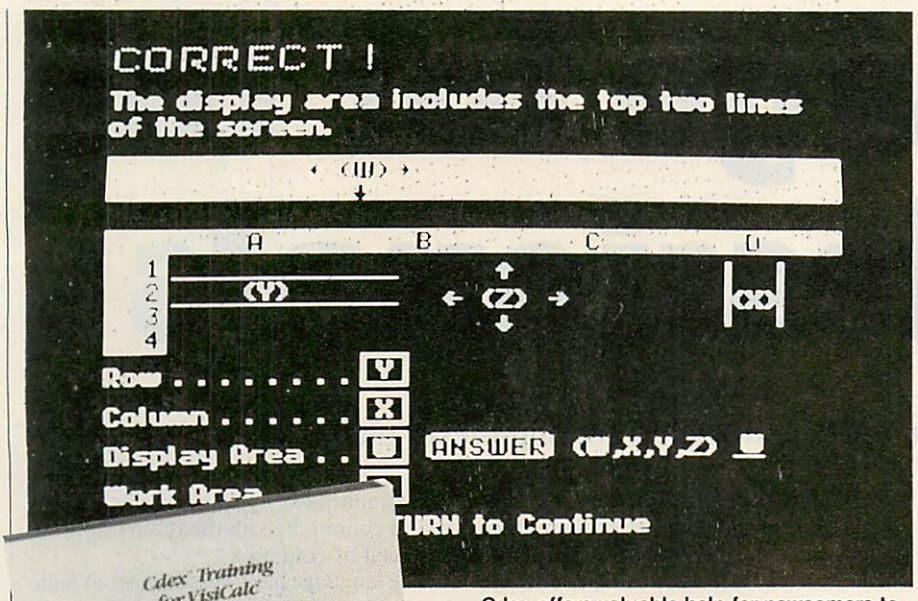
After I had worked through discs 1 and 2 VisiCalc seemed far more understandable. To complete the package there is a Cdex manual containing 62 pages. If you have any hang-ups about using VisiCalc, Cdex soon clears them up.

Unlike VisiCalc, Multiplan is supplied on two discs: a boot disc and a program disc. Multiplan needs the 48K of the Apple, plus the 16K of the language card or extra RAM card. Logically starting with disc 1, I loaded it and switched on, only to be presented with the message:

Not Multiplan Boot Disk

so I replaced it with disc 2 to see:

Insert system disk and press Return or press ESC for utilities.



Cdex offers valuable help for newcomers to spreadsheets.

These utilities appear on a menu with five choices:

1. Copy diskettes.
2. Initialise new data diskette.
3. Terminal configuration.
4. Exit utilities.
5. Copy Multiplan boot diskette.

The main option of interest is the Terminal configuration. As Multiplan gives the option of either a 40- or 80-column display, pressing 3 produces a list of seven different choices. After selecting the option, you reinsert the boot disc to allow the program to adapt to this change, and a message then appears:

Insert System Disk

The size of memory available for the Multiplan model is 20K, so the theoretical size of the electronic worksheet is a massive 63 columns by 255 rows. The amount that can actually be used in practice is far smaller. Rather than see this as a drawback with Multiplan, just divide the model into smaller units, and use the commands to link different modules.

The individual cells containing specific information and calculations can be protected so that they cannot be cancelled by mistake. Columns and rows in calculations using VisiCalc appear as a combination of letters and numbers like A1, B1 C4, etc. Using Multiplan you can have

Sales – Overheads = Profit

As an incentive for the user who wants to change over from VisiCalc, Multiplan lets you use your existing VisiCalc files. Existing data can be used with functions that are not available on VisiCalc.

In the 80-column mode there are seven columns and 19 rows on the screen, while the 40-column mode displays four columns by 18 rows. When the program has been loaded there is 20K available in the 40-column mode, and slightly more than 21K when in 80 columns. VisiCalc has 19K using the 48K Apple, but when the 16K RAM card is added the space available for the VisiCalc worksheet increases to 34K. Quite a difference.

To move the cursor you press Ctrl plus another character for left or right, up or down. All four characters are close together. Typing H for the Help feature almost takes the place of having a manual at all. This feature sets Multiplan apart from VisiCalc, together with the facility of using 40 or 80 columns and the extra features not available on the earlier product.

Unlike Multiplan, VisiCalc is supplied on a single disc and can be removed from the drive once the program has been booted up. The program copy is protected, so there is no possibility of making a back-up. As VisiCalc only works in the 40-column mode with the Apple, it appears to have been left behind by Multiplan. Certainly the new program does have features not available with VisiCalc, but equally the originator of the spreadsheet shouldn't be considered just on face value.

Now VisiCalc is the centre of a complete electronic-spreadsheet industry where buying the program is just the start. VisiCorp has produced a complete range of compatible programs extending the use of the information used in the VisiCalc models. The hardware and software companies have produced a range of accessories which offer far more features, and cope with many of the features that are offered by Multiplan.

It was more difficult to use than Multiplan, until I discovered Cdex and then learned to use VisiCalc very quickly. The drawbacks of the 40-column display and size of the model when compared with Multiplan's facilities have been solved by other companies.

One of the leading companies in the field is Vergecourt, which has produced both hardware and software products to extend VisiCalc. The Super Expander 80.2 provides an 80-column display plus three new commands, Local, Overwrite and Format+. Combine this package with a Ramex 128K memory-expansion board and you can create a 138K model.

Whether you want the latest state-of-the-art spreadsheet package or the trendsetting VisiCalc package, before making a final decision take the following steps. Examine what you want to do and would like to be able to do with a minimum of bother. Then see a demonstration of the chosen package. Unlike programs that you take home and use right away, the electronic spreadsheet is too sophisticated to be judged on price alone.

If you expect the new product to eliminate the old stager, forget it. Things are never that simple and if they were the number of software products would drop dramatically. Working out financial spreadsheet models requires concentration and a knowledge of exactly what you want to do. If you don't bother to understand the sophistication of either package, your results will be a let down.

Multiplan offers more in its basic form than VisiCalc, plus a greater ease of use, a built-in help facility and a choice of 40- or 80-column display. VisiCalc still has the edge with the number of programs and accessories that make it the heart of a financial spreadsheet system. Some of the extra features of Multiplan are available through the independent products available for VisiCalc, though these extra features make the total investment in VisiCalc higher than Multiplan. PC

Suppliers and prices

Multiplan: Microsoft U.K., Bulbourne House, Gossoms End, Berkhampstead, Hertfordshire. Telephone: (04427) 75091. £179.

VisiCalc and all Visi products: Rapid Recall Ltd, Rapid House, Denmark Street, High Wycombe, Buckinghamshire. Telephone: (0494) 26271. £164.

Cdex: Computer Resources & Technology Ltd, Alpha House, Rowlands Way, Manchester M22 5RG. £59.95.

VisiCalc utilities: Saturn extra memory boards and VisiCalc accessories. Pete & Pam Computers, New Hall Hey Road, Rawtenstall, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 227011.

VisiCalc expansion: 80 columns, 16K, 128K memory expansion. Vergecourt Ltd, 17 Nobel Square, Basildon, Essex SS13 1LP. Telephone: (0268) 728484.

Package for the professionals

Mike Lewis looks at Micromodeller, designed for high-level planning and analysis.

MICROMODELLER is an extremely powerful planning tool that goes far beyond the familiar VisiCalc-type packages. Not so much a spreadsheet system, it is more like a high-level programming language designed specifically for professional planners, economists and management accountants.

By the same token, Micromodeller is not the best software for the occasional user or for one-off applications. It can take considerable effort to learn, and setting up new jobs can be time-consuming. The package comes into its own when the volumes of data are very high or when the same model is going to be used many times.

Jobs that are suitable for Micromodeller include strategic planning, economic modelling, investment analysis and detailed budgeting for large companies. The software runs under CP/M and CP/M-86, and there is also an Apple version. The version I have been using is tailored for the Sirius 1 and is distributed by ACT Pulsar.

The package consists of a number of modules:

- An editor which you use to set up Micromodeller programs, data and command files.
- A compiler which converts your source program into an internal format.
- A data-entry module; you can enter data via the keyboard or from an external file.
- A run-time module which interprets and executes interactive commands.
- A report generator.
- A job processor which allows you to hold a sequence of commands on a disc file for execution as a batch.

The best way to use Micromodeller is at two levels. First a skilled user designs the model, writes and tests the programs, and sets up a job file. He or she then hands this over to a non-technical user who actually operates the model. At this lower level the user does not need to know anything about Micromodeller itself, only about the immediate application. If necessary, the model can be made menu-driven.

Imagine, for example, a program that models the performance of your company. The programmer, or model designer, would define the many relationships — such as sales less cost of sales equals gross profit. The end-user could be the company's accountant or financial director, who supplies the actual values, tests the effects of changes on these values, requests reports, and so on.

A Micromodeller program addresses a large area of memory called the workspace. It has some 13,000 locations, or cells, each of which is identified by row and column co-ordinates. Naturally, the workspace cannot be held entirely in RAM; most of it overflows to disc though the user does not need to be aware of this.

Although the programming language is straightforward, the instruction format can be a little confusing until you get the hang of it. For example, Micromodeller interprets an integer as an address,but if the number has a decimal point it is treated as an actual value. Thus

```
10 = 2 * 3/100.0
```

means that row 2 is divided by row 3 then multiplied by 100, with the results stored in row 10.

The distinction between rows and columns is usually a matter of context. The statement:

```
COL 8 = 6 ROW 1 * 9
```

means that the contents of column 6, row 1 are multiplied by the contents of each cell in column 9, with the results stored in each cell of column 8.

The language has a vast number of high-level functions. Many of them are especially relevant to financial planning, such as internal rate of return and loan amortisation. One very useful feature is table look-up. You can define various types of tables, then extract values from them according to reference values.

Having written the program, you use the editor to put it on to disc. It is an ordinary line-oriented text editor: apart from the fact that it can be invoked from Micromodeller command level, it is independent of Micromodeller and could be used for any type of text file. Like CP/M's Ed and Microsoft's Edlin, it works by appending a sequence number to each line. When you insert or delete a line, the lines are automatically renumbered. I have always found this method confusing and I prefer to do most of my Micromodeller editing with a full-screen editor such as WordStar.

The next step is to compile the program, which is achieved by a simple instruction at command level. The process only takes

Who's Who in the market?

You can expect some confusion in the distribution arrangements for Micromodeller. The package is an American one, launched originally for the Apple by Ferox Microsystems. A CP/M version quickly followed. The North American marketing was undertaken by technical publisher Addison-Wesley; in 1981 Intelligence U.K. took over distribution for the rest of the world.

Earlier this year, Ferox announced plans for a London office, from where it would market an upgraded version of Micromodeller called Micro-DSS. Intelligence plans to continue as the main distributor of the original package, or rather of its own upgraded version. Meanwhile Intelligence is thought to be thinking seriously about setting up its own selling arm in the U.S. and Ferox is said to be renegotiating its contract with Addison-Wesley. To add to the confusion, ACT Pulsar is busily selling a 16-bit version for the Sirius 1. ACT is offering the package at £595, which is £50 less than Intelligence's advertised price.

Intelligence U.K. claims over 4,000 Micromodeller installations, many of them in large companies that used to do their modelling on expensive time-sharing systems. There is also an active user group, based in London.

Intelligence U.K. Ltd is at 271 Kingston Road, London SW19; telephone 01-543 3711. ACT (Pulsar) Ltd is at 24 Highfield Road, Edgbaston, Birmingham; telephone 021-455 7000.

a few moments. Of course, if you alter a program afterwards you have to compile it again.

Before you can run the progam you have go go through data-entry stage. Micromodeller keeps data completely separate from programs, so it is easy to run the same model with different values. For example, you could write a program that forecasts cash flow then run it with data from a number of different companies.

Data may be entered from the keyboard or from an external file, and it is possible to combine data from different sources. Another useful feature is the ability to define temporary data: you can key in specific values to test their effect, then wipe them out and restore the original values.

The actual running of the model is achieved by the Calc command, which executes a specified program on the supplied data. There is also a QCalc command, which runs slightly faster by omitting certain run-time checks. Micromodeller provides three methods of presenting the results of the run, of which the most powerful is called formal reporting.

The formal reporting function is really a highly sophisticated report generator, as good as any that I have seen on a micro. Again the approach is a programming one. You write a report-specification program that is held on disc and which may be run at any time, using whatever data is currently held in the workspace.

There is virtually no limit to the way that you can define a report. Text and data may be freely mixed, and there is plenty of scope for headings, subheadings, page breaks, and so on. it can include escape sequences to take advantage of any special features of the hardware, such as expanded print.

The problem with all this is that, like the model itself, report programs are quite an effort to set up. However, there is an alternative method called quick reporting which simply displays or prints a rectangular portion of the workspace. It does no editing and includes no text except for any labels that were defined in the original model.

The third method of seeing the results of a model is called Dataview, a subsystem of Micromodeller which looks similar to a conventional spreadsheet program. You can tell it to display any rows and columns of the workspace, not necessarily adjacent ones. There is no scrolling; the only way to move the window is to type in further row or column numbers.

A few of the normal Micromodeller commands are also available in Dataview. You can enter temporary values, recalculate the model and immediately see the results on the screen.This is not quite as powerful as it may sound because you cannot, at this point, alter the actual model itself. To do so would require you to amend your original program and recompile it.

Two final features of Micromodeller are designed to take the end-user even further away from the technical aspects of the software, leaving him or her free to concentrate on the model itself. The Job command is used to execute a frequently used series of commands from a disc file. You can use it, in limited circumstances, to automate an entire modelling session.

The Gen function, which is really an interactive language in its own right, sits on top of the normal Micromodeller language and commands. It enables the programmer to create menu-driven systems and to run entire sessions by means of simple prompts and answers.

Two ancillary products have recently been announced by Intelligence U.K. Micro Linkline, which costs £395, transfers data between Micromodeller and other systems. It was originally intended for users to download their models from time-sharing bureaux, but it can be used independently of Micromodeller. Micro Graph Power converts Micromodeller data to graphical output via a digital plotter, and costs £410. It can produce pie charts, histograms, time-series graphs and several others. Intelligence U.K. also offers Modeller 11, a version for the PDP-11 under RSTS.

Micromodeller commands.

AF — Add saved data to the existing data in the workspace.
BEEP — Ring the bell at the console.
C — Clear the screen and home the cursor.
CALC — Run the model.
CHANGE — Change selected cells by a fixed amount or a percentage.
CLEAR — Set workspace to zero.
CL — Compile.
COL — Change the number of columns in the workspace.
CONVERT — Switch command entry between capitals and lower case.
COPY — Copy a file.
DATAVIEW — Enter Dataview subsystem.
DBF — Divide each cell by saved values.
DEC — Number of decimal places for Scan, Print and QR.
DESTROY — Delete a file.
DIR — Display a disc directory.
DISK — Change the default drive.
DIV — Divide selected rows by a row or constant.
EDIT — Invoke the text editor.
END — Exit Micromodeller.
EXTRACT — Put selected saved data into the workspace.
GD — Put a saved matrix into the workspace.
GEN — Invoke a Gen program.
ID — Use a specified text file as data.
JOB — Run a batch of commands from a file.
MBF — Multiply each cell by saved values.
MULT — Multiply selected rows by a row or constant.
PDIR — Print a disc directory.
PRINT — Print a rectangular portion of the workspace.
QCALC — Run the model, but without certain range checks.
QR — Quick report of part of the workspace.
REPORT — Run a report program.
RET — Return to Micromodeller from Dataview or editor.
SAVEREP — Like Report, but creates text file on disc.
SCAN — Display selected row names.
SD — Save the model on disc.
SF — Subtract saved data from existing data in the workspace.
SIMULT — Run the model for simultaneous relationships.
SL — Shift all columns leftward.
SR — Shift all columns rightward.
TD — Enter temporary data.
TV — Enter a single value without affecting other values.
UL — Invoke a model.
UPDATE — Update selected columns without affecting other values.
WS — Print a data-entry sheet.

Program Functions.

SUM — Total of several rows or columns.
COL — Address a specific column within a row.
ROW — Address a specific row within a column.
ROUND — Use rounded values.
TRUNC — Use truncated values.
POWER — Raise to a power.
% — Express a value as a percentage.
ABS — Returns the absolute value of an expression.
LOOPCOL — Calculate column by column rather than row by row.
ENDLOOP — Cancel the previous Loopcol.
MIN — Returns the lesser of two rows, column by column.
MAX — Returns the greater of two rows, column by column.
THRU — Define a look-up table.
LOOKUP — Retrieve a value from a look-up table.
LAG — Use row values shifted to the right.
LEAD — Use row values shifted to the left.
SPREAD — Apply spread factors to each value in a row.
CUM — Accumulate values within a row.
NPV — Compute net present value.
NPVPERPET — Compute net present value for a perpetual cash flow.
MULTINPV — Compute net present values for different discount rates.
IRR — Compute internal rate of return.
IRRPERPET — Compute internal rate of return for a perpetual cash flow.
PAYBACK — Compute the pay-back period for a cash flow.
DEPR — Compute depreciation according to specified rules.
SYD — Compute sum-of-years-digits depreciation.
INTEREST — Compute interest on mortgage-type loan.
PRINCIPAL — Compute principal and total payment on mortgage-type loan.
BALANCE — Compute remaining balance on mortgage-type loan.
LOSSCF — Compute year-by-year tax loss carry-forward.

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Runs on: Acorn Atom; 12K
Disc or cassette: 4K ROM
Columns/rows: 62/255
Graphics capability: No
Report generator: No
Supplier: Acornsoft, 4a Market Hill, Cambridge CB2 3NJ. Telephone (0223) 316039.

BUSICALC
Runs on: Commodore Pet, Vic-20, 64; 16K
Disc or cassette: either
Columns/rows: varies
Maximum number of cells: 2,000
Graphics capability: No
Report generator: No
Price: £40
Supplier: Supersoft, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex. HA3 75J. Telephone: 01-861 1166.

CALCRESULT
Runs on: Commodore 8000, 64; 32K
Columns/rows: 64/254
Maximum number of cells: 12,800
Graphics capability: Yes
Report generator: Yes
Price: £99
Supplier: Kobra Micro Marketing, PO Box 28, Henley-on-Thames, Oxfordshire RG9 1PF. Telephone: (04912) 2512.

CALCSTAR
Runs on: CP/M, Apple II, Tandy; 56K
Disc or cassette: disc
Columns/rows: 63/36
Maximum number of cells: 600
Graphics capability: No
Report generator: Yes
Price: £150
Supplier: Micropro, 31 Dover Street, London W1. Telephone: 01-499 5777.

EASICALC
Runs on: Sharp PC 1500; 8K
Disc or cassette: cassette
Columns/rows: 26/99
Maximum number of cells: 305
Graphics capability: No
Report generator: No
Price: £19.95
Supplier: Elkan Electronics, Freepost, Prestwich, Manchester M25 6LZ. Telephone: 061-798 7613.

EASYCALC
Runs on: Commodore 64; 64K
Columns/rows: 64/264
Maximum number of cells: 16,800
Graphics capability: Yes
Report generator: Yes
Price: £75
Supplier: Commodore, 675 Ajax Avenue, Slough, Berkshire. Telephone: (0753) 79292

IMPS
Runs on: CP/M; 48K
Disc or cassette: disc
Maximum number of cells: 2,500
Graphics capability: Yes
Report generator: Yes
Price: £280
Supplier: Ideal Computer Systems, 2 Cambridge Road, Kingston, Surrey KT1 3JU. Telephone: 01-549 3463.

MULTIPLAN
Runs on: Apple II, CP/M, MS-DOS; 56K
Disc or cassette: disc
Columns/rows: 63/255
Graphics capability: No
Report generator: No
Price: from £179
Supplier: Microsoft, Bulbourne House, Gossoms End, Berkhamstead, Hertfordshire. Telephone: (04427) 75091.

MASTERPLANNER
Runs on: CP/M; 64K
Disc or cassette: disc
Columns/rows: 1,000/5,000
Maximum number of cells: 7,000
Graphics capability: No
Report generator: Yes
Price: £245
Supplier: Comshare Ltd, 32-34 Great Peter Street, London SW1P 2DB. Telephone: 01-351 4399.

MICRO-FINAR
Runs on: CP/M, IBM PC, MP/M, DEC Professional, MS-DOS; 64K
Disc or cassette: disc
Columns/rows: unlimited
Maximum number of cells: 32,000 on 999 spreadsheets
Graphics capability: Yes
Report generator: Yes
Price: £750 single user; £950 MP/M
Supplier: Corporate Modelling Consultants, Friendly House, 21-24 Chiswell Street, London EC1Y 4UD. Telephone: 01-920 0041.

LOGICALC
Runs on: Apple II, IBM PC, Corvus Concept; 64K
Disc or cassette: disc
Columns/rows: 127/255
Maximum number of cells: 32,385
Graphics capability: No
Report generator: Yes
Price: £195
Supplier: Keen Computers Ltd. 6 Giltspur Street, London EC1. Telephone: 01-236 5682.

PEACHCALC
Runs on: IBM PC, CP/M; 44K
Disc or cassette: disc
Columns/rows: 63/256
Maximum number of cells: 16,000
Graphics capability: No
Report generator: Yes
Price: £200
Supplier: Peachtree Software Ltd, 43/53 Moorbridge Road, Maidenhead, Berkshire. Telephone: (0628) 32711.

PLAN 80
Runs on: CP/M, MS-DOS, CP/M-86; 56K
Disc or cassette: disc
Columns/rows: rule-based
Graphics capability: No
Report generator: Yes
Price: £250
Supplier: Lifeboat Associates, PO Box 125, London WC2H 9LU. Telephone: 01-836 9028.

PLANNERCALC
Runs on: DEC, Hewlett-Packard, Osborne, Xerox; 64K
Disc or cassette: disc
Columns/rows: 128/512
Maximum number of cells: 900
Graphics capability: No
Report generator: Yes
Price: £85
Supplier: Comshare Ltd, 32/34 Great Peter Street, London SW1. Telephone: 01-351 4399.

PRACTICALC
Runs on: Commodore 64, Vic-20; 16K
Disc or cassette: cassette or disc
Maximum number of cells: 2,000
Graphics capability: Yes
Report generator: No
Price: £24.95 tape, £29.95 disc
Supplier: Marketing Micro Software Ltd, Goddard Road, Whitehouse Industrial Estate, Ipswich, Suffolk. Telephone: (0473) 462721.

SCRATCH-PAD
Runs on: CP/M MS-DOS; 48K
Disc or cassette: disc
Columns/rows: unlimited
Maximum number of cells: unlimited
Graphics capability: No
Report generator: No
Price: £140
Supplier: The Software Source. Telephone: 01-387 8832.

SPREADSHEET ANALYSIS
Runs on: Dragon 32, BBC; 32K
Disc or cassette: cassette
Graphics capability: No
Report generator: Yes
Price: £19.95
Supplier: Gemini, 9 Salterton Road, Exmouth, Devon.

SUPERCALC
Runs on: Sirius, IBM PC, CP/M, MS-DOS; 64K
Disc or cassette: disc
Columns/rows: 63/254
Maximum number of cells: 2,400
Graphics capability: on Supercalc II
Report generator: on Supercalc II
Supplier: Xitan Systems Ltd, 23 Cumberland Place, Southampton SO1 2BB. Telephone: (0703) 334711.

THE SPREADSHEET
Runs on: ZX Spectrum, 48K
Disc or cassette: cassette
Columns/rows: 26/99
Maximum number of cells: 800
Graphics capability: No
Report generator: No
Price: £9.95
Supplier: Microl, Freepost, 31 Burleigh Street, Cambridge CB1 1BR. Telephone: (0223) 312452

T/MAKER
Runs on: CP/M, Apple II, MS-DOS, PC-DOS; 48K
Disc or cassette: disc
Columns/rows: 25/300
Graphics capability: Yes
Report generator: Yes
Price: £165
Supplier: TCL Software, 59-61 Theobalds Road, London WC1. Telephone: 01-402 8137.

UNICALC
Runs on: Unix, 8080-based machines, IBM-PC, CP/M, CP/M-86; 64K
Disc or cassette: disc
Columns/rows: 64/255
Maximum number of cells: 16,320
Graphics capability: Yes
Report generator: Yes
Price: £130
Supplier: Lifeboat Associates, PO Box 125, London WC2H 9LV. Telephone: 01-836 9028.

VISICALC
Runs on: a wide range of machines; 48K
Disc or cassette: disc
Columns/rows: 63/254
Maximum number of cells: 7,000
Graphics capability: No
Report generator: No
Price: £170
Supplier: Rapid Terminals Ltd, Rapid House, Denmark Street, High Wycombe, Buckinghamshire. Telephone: (0494) 26271.

VUFILE
Runs on: Sinclair Spectrum, ZX-81; 16K
Disc or cassette: cassette
Graphics capability: No
Report generator: No
Price: £8.95
Supplier: Sinclair Research; available in High Street shops.

Formcalc

Brian Law introduces a real spreadsheet program which runs on a 16K ZX-81.

FORMCALC is a versatile, general-purpose mathematical program for use on the ZX-81 with 16K RAM. It lets you work on large quantities of data which may be from commercial, industrial or scientific applications.

Raw data is entered in columns, and formulae can be entered above each column for the results to be calculated below. Data can be manipulated either by making individual changes or by changing all of it in a variety of controlled ways.

Results of calculations can be sorted in ascending order and returned to the original input sequence. "What if" facilities are built in so that all results can be recalculated after changing the input data.

All data and results are automatically stored on tape under the Save command. There is also the option of storing only the formula if the program is to be used for specific calculating routines.

The program is written in Basic and should be run in the Fast mode. No machine-code routines are used, so delays of up to 15 seconds can occur on the Shift commands. A total recalculation can usually be completed within 30 seconds even on the most complex projects.

The program is set out in modular form, the modules being linked by lines 170 to 295. The first part of the program, up to line 165, is concerned with setting up the screen display and initialising the variables. Line 35 dimensions the string that will hold the formula to be entered later, which may be up to 50 characters long. If more are required this line should be changed accordingly. Line 37 dimensions the string that will hold the column headings, up to a maximum of six characters.

Line 40 dimensions the subscripted variable that holds all the figures that will be printed on the worksheet. Its usual appearance in the program listing will be Q(R,C) where R is used to define the row number and C the column number. In the special form Q(N,C), where N is the last row, all the sums of columns are printed.

The subscripted variable C(V) in line 66 holds the value for the vertical print position used in line 2305. It is initialised in lines 65 to 67 and tailored to fit the number of rows visible on the screen.

Line 70 is used where the number of lines visible on the screen is being changed. After going to line 800 to change the value of C1 the program sends you back to 65 to change C(V) and then to 1315 to reprint the screen.

Lines 110 to 140 print the row number down the side of the sheet. Lines 152 to 156 print the column numbers at the top of the sheet. The variable T, which usually has a negative value, is used to determine which column is to be the first one printed on the screen. C1 holds the value of the number of columns to be visible. Line 157 sends the program off to reprint column headings following the CL command.

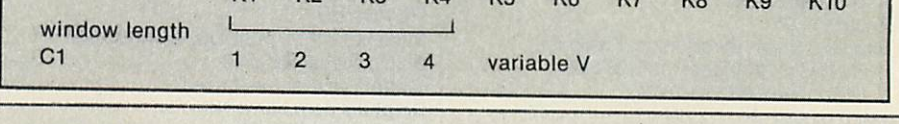
Lines 170 to 298 respond to the command which has been input in line 160 to send you off to the appropriate part of the program. Line 299 sends you back to the command line if the input is illegal.

If you are using 10 columns and only four are visible at a time, the program has to determine which four are to be printed. Initially the screen is set up with the first four columns visible as shown in figure 1. If you wish to move the window to the right you have to go to the shift routine. Variable T in line 315 is decremented by 1 to become −1. Since the window is being moved one place to the right, column 2 becomes the front edge of the window, that is V = 1 when C = 2 and T = −1. A similar line is needed in all program sections to achieve the correct print position.

The subroutine for the entry of single values down a column starts at line 300. Line 320 is the start of the input loop. Line 322 sets up the variable R1 which does for rows what V does for columns. Line 330 prints a * in the position that the value will be printed. Line 340 inputs that value, with line 350 sending off for it to be printed. Line 355 calls the scrolling once the maximum number of rows has been reached on the screen.

Line 325 is used to enter the formula

Figure 1.




```
   4 REM "FORMCALC"
   5 CLS
   6 PRINT AT 5,10;"FORMCALC";A
 7,10;"BY B.R.LAW";AT 9,10;"25/
/82";AT 13,0;"DO YOU WANT 1 NEW
WORKSHEET";AT 15,12;"2 STORED D
TA";AT 17,12;"3 STORED FORMULA"
  14 INPUT X$
  15 CLS
  16 IF X$="2" THEN GOTO 1315
  17 IF X$="3" THEN GOTO 2000
  18 PRINT AT 0,0;"ENTER NO OF F
OWS REQUIRED"
  20 INPUT N1
  24 LET N=N1+1
  28 PRINT AT 0,0;"ENTER NUMBER
OF COLUMNS REQUIRED"
  30 INPUT M
  31 PRINT AT 0,0;"HOW MANY COLU
MNS TO BE VISIBLE  ON SCREEN"
  32 INPUT C1
  35 DIM A$(M,50)
  37 DIM H$(M,6)
  40 DIM Q(N,M)
  50 DIM C(M)
  55 LET I$=""
  60 LET T=0
  65 FOR V=1 TO C1
  66 LET C(V)=(V*INT (30/C1)-INT
(21/C1)+1)
  67 NEXT V
  70 IF I$="CC" THEN GOTO 1315
  74 LET J=0
  76 LET K=0
  78 LET S=0
  80 IF I$="T" THEN GOTO 1315
100 LET L=N1
105 LET S=0
106 IF L>17 THEN LET L=17
107 PRINT AT 2,0
110 FOR X=1 TO L
120 LET S=S+1
130 PRINT S
140 NEXT X
150 PRINT AT 0,0;"COMMAND?
   ";N1;"R";"   ";M;"C";"  ";INT
 (((PEEK (16386)+PEEK (16387)*25
6)-(PEEK (16412)+PEEK (16413)*25
6))/10+.5)/100;"K"
 151 PRINT "==================
==========="
 152 FOR C=1 TO C1
 154 PRINT AT 1,(C*INT (30/C1))-
INT (12/C1);"K";C-T
 156 NEXT C
 157 IF I$="CL" THEN GOSUB 430
 160 INPUT I$
 165 PRINT AT 0,0;"
                  "
 170 IF I$="T" AND N1<18 OR I$="
B" AND N1<18 THEN GOTO 150
 180 IF I$="T" THEN GOTO 74
 190 IF I$="5" OR I$="8" OR I$="
B" THEN GOTO 1300
 200 IF I$="8N" OR I$="5N" THEN
GOTO 1500
 210 IF I$="7" THEN GOTO 1930
 220 IF I$="SORT" THEN GOTO 3000
 230 IF I$="RF" THEN GOTO 1600
 240 IF I$="RR" THEN GOTO 1700
 250 IF I$="S" THEN GOTO 700
 260 IF I$="C" THEN GOTO 300
 270 IF I$="H" THEN GOTO 400
 275 IF I$="CC" THEN GOTO 800
 280 IF I$="CH" THEN GOTO 1100
 285 IF I$="CL" THEN GOTO 2000
 290 IF I$="SC" THEN GOTO 5
 295 IF I$="0" THEN STOP
 298 IF I$="SAVE" THEN GOTO 3500
 299 IF I$<>"5" THEN GOTO 150
 300 REM enter individual values
 305 PRINT AT 0,0;"ENTER COLUMN
NO"
 310 INPUT C
 312 PRINT AT 0,0;"ENTER VALUES
    "
 315 LET V=C+T
 320 FOR R=1 TO N1
```

Q(R,C) into the column so that if the column has been occupied by values entered under the RF command, subsequent operations of the RR command return values to this column from the original RF command formula. Lines 400 to 425 allow you to enter headings above columns by asking you which column, line 402, what heading, line 410, and then calling for printing.

Line 422 is used to avoid going back to line 150, which significantly improves the response time for the command. Lines 430 to 460 are only used after a CL command has been used, and will reprint the column headings above the cleared sheet.

Lines 700 to 790 add all the values in a column and load the result into Q(N,C). Line 755 looks at the value of V; if it is not on the screen it is not printed. Line 770 sends you back to the recalculation routine if that is where you have just come from.

Lines 800 to 830 allow you to change the number of columns visible on the screen by changing the value of C1. Lines 900 to 920 allocate a special formula to the specified column to allow a progressive sum to be made.

Lines 1100 to 1190 allow you to change values previously entered. Line 1112 looks to see if there is a formula in A$(C) for this column and, if there is, it will print a warning; changing a value derived from a formula will automatically overwrite the formula with Q(R,C).

Line 1118 asks for the row number and number to be changed, and line 1180 sends off for summing if the column had previously been summed.

Lines 1300 to 1380 produce the Left and Right shifts of the window, the variable T being adjusted at lines 1305 and 1310. Line 1330 sends off for the heading to be printed, if there is one. Line 1335 looks to see if A$(C) is empty; if it is then there are no entries in that column to print.

Line 1340 sends off for printing values in the rows and line 1355 will omit the printing of the sum if none exists. Lines 1500 to 1530 allow variable T to be changed to specific values related to a specified column to be displayed on the screen first.

Lines 1600 to 1695 allow the formula to be entered for each column, and then calculate the results for each row. This calculation is carried out at line 1650. Line 1685 changes the formula from R to Q(R,C) in order to help the user keep track of the original row sequence when R is being used in a sort. Under these circumstances, if the formula were left as R then use of the RR commands after a sort would result in the R values being restored to their original order. The second part of line 1685 stops this formula substitution if R is used as part of a formula.

Line 1690 sends for summing if the column was previously summed. Lines 1700 to 1770 recalculate all the columns. Line 1705 will omit recalculation of a column if it holds only input data or is empty.

Line 1735 temporarily holds the value in Q(R,C) and then compares it with the recalculation at line 1750. In this way printing is avoided if there is no change in the value.

Lines 1800 to 1895 code the formula from the form K1/S1 to Q(R,1)/Q(N,1); it is far easier for the user to use S1 instead of Q(N,1). Line 1810 transfers the formula to an ordinary string to avoid the problem of working with a subscripted string of great fixed length. Line 1820 checks whether the end of the string has been reached, in which case it will send off to line 1890 to transfer the encoded formula to A$(C) before returning to the RF routine.

Line 1825 looks at each character in the

(continued on next page)

Use of the RF command.

K1 + K2. Adds column 1 to column 2
K1 – K2. Subtracts column 2 from column 1
K1 * K2. Column 1 × column 2
K1/K2. Divide column 1 by column 2
K1/S1 * 100. Divide column 1 by the sum of column 1
PI * (K1 ** 2)/4. Formula for area of circle where column 1 holds the diameter
R. Prints row number
R * .1. Prints row number x.1
10 + (R – 1). Increments the value of 10
10 – (R – 1). Decrements the value of 10
10 + (R – 1) * .1. Increments the value of 10
10 – (R – 1) * .1. Decrements the value of 10
10/1.1 * 1.1 ** R. Increments the value by 10 percent of previous value.
10/.9 * .9 ** 12. Decrements the value by 10 percent previous value
P. Progressively sums the previous column.
K1 × 1.1. Increases the existing values in column 1 by 10 percent. If this formula is used on column 1 itself, it must be neutralised afterwards.

Figure 2.

```
ENTER COLUMN NO TO BE SUMMED
    K1      K2      K3      K4
1
2
3
4
5
6
7
8
9
10
```

Figure 3.

```
ENTER COLUMN NO TO BE SUMMED
    K1      K2      K3      K4
    LOAD    LENTH   DIA     DEFL
1   1       24      0.25    5.47
2   2       24      0.25    6.34
3   3       24      0.25    1.42
4   4       24      0.25    1.59
5   5       24      0.25    2.36
6   6       24      0.25    2.53
7   7       24      0.25    3.3
8   8       24      0.25    3.77
9   9       24      0.25    4.25
10  10      24      0.25    4.72
```

```
 322 LET R1=R-K
 325 LET A$(C)="Q(R,C)"
 327 IF R1<1 THEN GOTO 340
 330 PRINT AT R1+2,C(V);"*"
 340 INPUT Q(R,C)
 345 IF R1<1 THEN GOTO 360
 350 GOSUB 2300
 352 IF R=N1 THEN GOTO 150
 355 IF R1>16 THEN GOSUB 1900
 360 NEXT R
 370 GOTO 150
 400 REM column headings
 402 PRINT AT 0,0;"COLUMN NUMBER
"
 405 INPUT C
 407 LET V=C+T
 410 PRINT AT 0,0;"COLUMN HEADIN
G"
 415 INPUT H$(C)
 417 IF V<1 OR V>C1 THEN GOTO 42
2
 420 GOSUB 2350
 422 PRINT AT 0,0;"COMMAND?
"
 425 GOTO 160
 430 PRINT AT 2,0;"
                  "
 435 FOR C=ABS T+1 TO ABS T+C1
 440 IF C>M THEN RETURN
 445 IF H$(C,1 TO 2)="  " THEN G
OTO 455
 447 LET V=C+T
 450 GOSUB 2350
 455 NEXT C
 460 RETURN
 700 REM sum value of a column
 705 PRINT AT 0,0;"ENTER COLUMN
NO TO BE SUMMED"
 710 INPUT C
 712 LET V=C+T
 715 LET Q(N,C)=0
 730 FOR R=1 TO N1
 740 LET Q(N,C)=Q(N,C)+Q(R,C)
 750 NEXT R
 755 IF V<1 OR V>C1 THEN GOTO 77
0
 760 GOSUB 2400
 770 IF I$="RR" THEN GOTO 1765
 790 GOTO 150
 800 REM change column spacing
 810 PRINT AT 0,0;"HOW MANY COLU
MNS TO BE VISIBLE"
 820 INPUT C1
 830 GOTO 65
 900 REM progressive sum
 910 LET A$(C)="Q(R,C-1)+(R<>1)*
Q(R-1*(R<>1),C)"
 920 GOTO 1635
1100 REM change a value
1102 LET X$="Y"
1105 PRINT AT 0,0;"ENTER COLUMN
NUMBER"
1110 INPUT C
1112 IF A$(C,1 TO 6)<>"Q(R,C)" A
ND A$(C,1 TO 2)<>"  " THEN PRINT
 AT 0,0;"rf column still change!
 y\n     "
1114 IF A$(C,1 TO 2)<>"  " AND A
$(C,1 TO 6)<>"Q(R,C)" THEN INPUT
 X$
1116 IF X$<>"Y" THEN GOTO 150
1118 PRINT AT 0,0;"ENTER ROW NO
AND NEW NUMBER     "
1120 INPUT R
1125 LET R1=R-K
1130 LET V=C+T
1140 INPUT Q(R,C)
1150 LET A$(C)="Q(R,C)"
1160 IF V<1 OR V>C1 OR R1<1 OR R
1>17 THEN GOTO 1180
1170 GOSUB 2300
1180 IF Q(N,C)<>0 THEN GOTO 715
1190 GOTO 150
1300 REM left\right shift
1305 IF I$="5" THEN LET T=T-1
1310 IF I$="8" THEN LET T=T+1
1312 IF I$="B" THEN LET K=N1-17
```

(listing continued on next page)

Formcalc

(continued from previous page)

formula to determine whether it is an S or a K; if it is not it goes to 1860 to be transferred to C$ as it is. X$ is then allocated an N or an R to be used later to compile either Q(R,?) or Q(N,?). Line 1840 looks for functions so as to determine the number of digits following the S or the K and sends off to 1845 in the case of two digits and 1875 in the case of one digit. Lines 1850, 1865 and 1885 increment X so that the search through the string can continue.

Lines 1900 to 1930 scroll the screen when the C command is in use and the last of the visible rows has been reached. Lines 1930 to 1998 scroll the screen in response to the 7 command and print the next row of values at line 1985.

Lines 2000 to 2035 clear the worksheet of all data but leave the formula intact. At line 2009 Q(R,C) is set to zero, but because a formula may require a number to be divided by the sum of a column, all cleared sum values are given value of .001. This ensures that when next used the column will be summed and hence be usable in any formula.

Lines 2300 to 2410 are the print routines. The printed result is rounded to two decimal places.

Lines 3000 to 3100 make up the Shell-Metzner sort used to sort columns in ascending order. It will sort on a specified column and also allow you to decide which columns will follow the sort. This last feature can be useful for saving time, and it is accomplished in the loop starting at line 3074. All columns between X and Q will follow the sort.

Line 3500 saves the program and ensures that it will start automatically when loaded.

Once loaded, the program will automatically start and display a menu. You are asked to enter 1, 2 or 3, depending on what you require: 1 gives you a new worksheet with all previously stored data cleared out; 2 reprints the worksheet as you left it when saved; 3 will give you a clean worksheet but previously stored formula will remain.

To start with you should enter 1. The display will then change and ask you to enter the number of rows required. Then enter 10, and the display calls for the number of columns required.

The maximum number is dependent on the number of rows in use; approximately 1,100 individual locations can be used. For four rows enter 4. The display now changes to

ENTER NUMBER OF COLUMNS TO BE VISIBLE ON SCREEN

Depending on the length of a number in use the screen becomes cluttered above six columns, so enter 4.

The screen should now look like the one shown in figure 2. The word Command in the top line indicates that the computer is waiting for a command input which should be one of those listed in table 1. The number of rows available is indicated by 10R, and the number of columns by 4C. The amount of free memory available is 8.06K. K1, K2, etc. are the column headings, and the rows are numbered down the left-hand side.

Figure 3 shows an example of the program in use. In this case it is set up to calculate the deflection of a steel bar fixed into a wall at one end and loaded at the other with progressively larger weights. To enter the headings, respond to the command input by entering H and then 1, to indicate that the heading is to be in column 1, followed by the heading itself. The same procedure is repeated for the other three columns.

To enter the values into the first three columns respond to the command input by entering C, followed by the column number. Then enter the program increments and the print position to the next row until the final row has been reached, at which time it will go back to the command input.

The formula for the deflection of a steel bar is

$(4 \times load \times length^3)/(30{,}000{,}000 \times diameter^4)$

To enter this into the fourth column, enter RF, followed by the column number and then the formula itself. The formula should be entered in form:

4 * K1 * K2 ** 3/(30,000,000 * K3 ** 4)

K1, K2 and K3 refer to the columns to be used in the formula. When it has been entered the screen will blank out for a few

Command inputs.

Functions.

C. Allows you to enter figures all down a column. An entry is required for each row and you cannot partially fill a column. This command is the only one where the column being entered has to be visible on the screen. All other commands will work on any column, visible or otherwise.

CC. Used to change the column spacing. By using this command and then specifying number of columns to be displayed, either more or fewer columns can be put on display.

CH. Used to change individual values in a column.

CL. Used to clear the worksheet but leaving any formula entered intact. It is useful for storing just formulae so that a frequently used calculation can be done quickly.

H. Allows you to enter a heading above each column which can have no more than six characters in it. You will be asked which column, and then for the heading.

(listing continued from previous page)

```
1313 IF I$="B" THEN LET S=N1
1315 CLS
1320 FOR C=ABS T+1 TO ABS T+C1
1322 IF C>M THEN GOTO 1367
1325 LET V=C+T
1330 IF H$(C,1 TO 2)<>"  " THEN
GOSUB 2350
1335 IF A$(C,1 TO 2)="  " THEN G
OTO 1365
1340 FOR R=ABS K+1 TO ABS K+L
1342 LET R1=R-K
1345 GOSUB 2300
1350 NEXT R
1355 IF Q(N,C)=0 THEN GOTO 1365
1360 GOSUB 2400
1365 NEXT C
1367 IF I$="T" THEN GOTO 105
1370 LET S=S-L
1380 GOTO 107
1500 REM column at front
1505 PRINT AT 0,0;"ENTER COLUMN
NO TO BE AT FRONT"
1510 INPUT X
1520 LET T=1-X
1530 GOTO 1315
1600 REM formula entry
1605 PRINT AT 0,0;"ENTER COLUMN
NUMBER"
1610 INPUT C
1617 PRINT AT 0,0;"ENTER FORMULA
     "
1620 INPUT A$(C)
1630 GOSUB 1800
1635 LET V=C+T
1640 FOR R=1 TO N1
1645 LET R1=R-K
1650 LET Q(R,C)=VAL A$(C)
1660 IF V<1 OR V>C1 OR R1<1 OR R
1>17 THEN GOTO 1680
1670 GOSUB 2300
1680 NEXT R
1685 IF A$(C,1)="R" AND A$(C,2)=
" " THEN LET A$(C)="Q(R,C)"
1690 IF Q(N,C)<>0 THEN GOTO 715
1695 GOTO 150
1700 REM relcalculation
1702 FOR C=1 TO M
1705 IF A$(C,1 TO 6)="Q(R,C)" OR
 A$(C,1 TO 2)="  " THEN GOTO 176
5
1710 LET V=C+T
1730 FOR R=1 TO N1
1732 LET R1=R-K
1735 LET X=Q(R,C)
1740 LET Q(R,C)=VAL A$(C)
1745 IF V<1 OR V>C1 OR R1<1 OR R
1>17 THEN GOTO 1760
1750 IF X<>Q(R,C) THEN GOSUB 230
0
1760 NEXT R
1763 IF Q(N,C)<>0 THEN GOTO 715
1765 NEXT C
1770 GOTO 150
1800 REM formula encode
1805 LET X=1
1810 LET B$=A$(C)
1815 LET C$=""
1820 IF X=LEN B$+1 THEN GOTO 189
0
1822 IF B$(X)="P" THEN GOTO 900
1825 IF B$(X)<>"K" AND B$(X)<>"S
" THEN GOTO 1860
1830 LET X$="R"
1835 IF B$(X)<>"K" THEN LET X$="
N"
1840 IF B$(X+2)="*" OR B$(X+2)="
/" OR B$(X+2)="**" OR B$(X+2)="+
" OR B$(X+2)="-" THEN GOTO 1875
1845 LET C$=C$+"Q("+X$+","+B$(X+
1 TO X+2)+")"
1850 LET X=X+3
1855 GOTO 1820
1860 LET C$=C$+B$(X)
1865 LET X=X+1
1870 GOTO 1820
1875 LET C$=C$+"Q("+X$+","+B$(X+
1)+")"
```

seconds before returning with the calculated result.

There are several easier ways of entering values. For instance, in columns 2 and 3 where the same value could be entered down the whole column, the RF command could have been called, and instead of entering a formula, enter the value.

Try this by entering another value for the length, for example, RF, followed by 2, followed by 30. This changes the length to 30 inches, but it has not changed the result in column 4. To do the recalculation you use the RR command, which will go through and recalculate everything.

Another useful short cut is to use the variable R as part of a formula. R is the variable holding the row number, so column 1 could have been entered using the RF command simply by entering R in response to the request for a formula. Try entering R + 9 under the RF command in column 1.

This will give you the values for the load of 10 to 19. Now use RR to recalculate. To change individual values in a column the CH command is used. It asks you for the column and row number of the value to be changed, and then the new number. Enter each of these three numbers separately.

If you try to change a value in a column generated by the RF command you will be challenged and asked to reaffirm your request with a Yes or No answer. If you change a value under these circumstances the formula is removed to prevent the changed value being changed back again during recalculation.

It is sometimes necessary to prevent a formula from working under the RR command. The circumstances under which this applies are as follows:

- If a formula contains it own column number followed by a +, −, *, /, ** or a number of other functions.
- If a formula contains a random function used to set up figures down a column.
- After a sorting operation.

If a column is not neutralised the next operation of the RR command will change the values in those columns and give erroneous results. Neutralising means entering as a formula as follows:

RF		RF
2	or	13
K2		K13

The RR command will then see this formula as telling it to take the values that are in column 3 and put them in column 3 — that is, to do nothing to column 3.

O. Takes you into Command mode, and hence the program listing.

RF. Used to enter a formula, the results of which are printed in the column. You have to specify which column the result is printed in. Three main categories of entry can be defined:
22.7 — single numbers can be entered and will then be printed in each row of the column.
(22.7 * 16.9)/ — Simple formula consisting of numbers or numbers and functions, the result being printed on every row.
K1 *K2 — The value in column 1 is to be multiplied by the value in column 2. This is carried out for each row.
K1/S1 * 100 — The value in columen 1 is to be divided by the sum of column 1 and then the result is multiplied by 100.
Column 1 has to have been summed or error code 6/1650 will result, because you are trying to divide by 0. The standard conventions apply, so if in doubt use parentheses. Correct syntax must be used or an error code will result. If you do get an error code, type in Goto 1315 to return to the worksheet.

RR. Recalculates every item on the worksheet if a change is made under the CH, C or RF commands. If your calculations are progessive, always work from left to right or the RR command will not work.

S. Adds up all the individual values in a column and then prints the sum at the bottom of the sheet. Once a column has been summed, any changes made to that column by any of the other commands will automatically result in the column being resummed.

SAVE. Type in Save, start recorder, press Newline and the program and all data will be saved. If you only wish to save the program you can save time both saving and loading by entering SC followed by 1,1, − 1, − 1 and Save. This will reduce the program to its minimum size.

SC. Cleans out the worksheet completely, removing all data and formulae.

Sort. Sort into ascending order all the values in a specified column. After specifying the column to be sorted you will be asked to specify the columns to follow the sort, first Sort from? and then Sort to?. The column to be sorted has to be between the specified columns.

Cursor functions.

5. The Left shift command, ←on the keyboard. Moves the displayed columns one to the left.

8. As above but Right shift.

5N. Moves the display to the left so that the column specified is at the front. For example, entering 5N followed by 6 changes the display from columns 1 to 5 to columns 6 to 10.

8N. Moves the display to the right.

7. Scrolls the screen one row at a time to bring into view those rows below the current screen display. The headings will gradually scroll off and will not be replaced until the last row is reached.

B. Takes you straight to the bottom 17 rows.

T. Will return you to the top 17 rows.

```
1880 LET X=X+2
1885 GOTO 1820
1890 LET A$(C)=C$
1895 RETURN
1900 REM scroll routine
1901 IF R1+2>N THEN RETURN
1905 LET K=K+1
1910 LET S=S+1
1915 PRINT AT 20,0;S
1920 SCROLL
1925 RETURN
1930 REM scroll shift
1935 LET J=J+1
1940 IF S=N1 OR R=N1 THEN GOTO 1
50
1945 LET R=17+J
1950 LET K=K+1
1955 LET S=S+1
1960 PRINT AT 20,0;S;TAB 3;"
                           "
1970 SCROLL
1975 FOR C=ABS T+1 TO ABS T+C1
1976 IF C>M THEN GOTO 160
1977 IF A$(C,1 TO 2)="  " THEN G
OTO 1994
1980 LET V=C+T
1985 PRINT AT 19,C(V);INT (Q(R,C
)*100+.5)/100
1990 IF Q(N,C)=0 THEN GOTO 1994
1992 GOSUB 2400
1994 NEXT C
1998 GOTO 160
2000 REM clear worksheet
2001 CLS
2006 FOR C=1 TO M
2008 FOR R=1 TO N1
2009 LET Q(R,C)=0
2010 NEXT R
2020 IF Q(N,C)<>0 THEN LET Q(N,C
)=.001
2022 NEXT C
2035 GOTO 74
2300 REM print routine
2305 PRINT AT R1+2,C(V);(INT (Q(
R,C)*100+.5))/100;" "
2310 RETURN
2350 REM print headings
2355 PRINT AT 2,C(V);H$(C)
2360 RETURN
2400 REM print sum routine
2405 PRINT AT 20,C(V);(INT (Q(N,
C)*100+.5))/100;" "
2410 RETURN
3000 REM shell metzner sort
3001 PRINT AT 0,0;"ENTER COLUMN
TO BE SORTED       "
3002 INPUT C
3003 PRINT AT 0,0;"SORT FROM?
                   "
3004 INPUT X
3005 PRINT AT 0,0;"SORT TO?   "
3007 INPUT Q
3009 LET R=1
3010 IF 2**R>N1 THEN GOTO 3025
3015 LET R=R+1
3020 GOTO 3010
3025 LET F=2**R-1
3030 LET F=INT (F/2)
3035 IF F=0 THEN GOTO 1315
3040 LET D=N1-F
3045 LET B=1
3050 LET R=B
3055 LET E=R+F
3060 IF Q(R,C)>Q(E,C) THEN GOTO
3074
3065 LET B=B+1
3070 IF B>D THEN GOTO 3030
3073 GOTO 3050
3074 FOR W=X TO Q
3075 LET T1=Q(R,W)
3080 LET Q(R,W)=Q(E,W)
3085 LET Q(E,W)=T1
3087 NEXT W
3090 LET R=R-F
3095 IF R<1 THEN GOTO 3065
3100 GOTO 3055
3500 SAVE "FORMCALc"
3501 GOTO 1
```

The U.K. budget

(continued from previous page)

workers to produce in successive time periods.

The next two equations are the most difficult to model. Together they determine the rate of inflation, which is perhaps the area present-day economists are most unsure of. Equations 6 gives the rate of wage inflation. It is broadly Keynesian-inspired: wage inflation is determined by expected inflation, which is proxied by actual inflation in the previous period, and the deviation of wages from some desired level. If wages have recently fallen below this desired level, workers will push for a wage increase to make good the difference.

Unemployment also effects the rate of wage inflation, but only when it rises above 6.5 percent, in which case high unemployment will tend to damp down wage increases. The effects of incomes policies are taken into account, both during the period when the policy operates and immediately after it ceases to operate.

Price inflation is determined in equation 7 and is simply a function of previous wage inflation, the rate of increase in fuel and raw-material prices and past inflation itself. Account is also taken of the effects of incomes policies, although in this case there appear to be no after effects. As the economy moves into a deep recession the influence of past inflation falls.

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VARIABLE	NEW VALUE	OLD VALUE
GDP AT MARKET PRICES	28796.3	27406
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INFLATION	16.4968	16.4966

Figure 1. The model simulated: the results do not make pleasant reading.

```
5 CLS
10 PRINT @ (9,15), "****MACRO ECONOMIC M
ODEL OF THE UK****"
20 PRINT @ (11,20),"****BY DR. JOHN HUDS
ON****"
25 PRINT @ (13,20),"****UNIVERSITY OF BA
TH****"
100 DIM X(50,40),Y(50,40),Z(20),C(30,10)
1000 READ N,M
1010 FOR I=1 TO M
1020 FOR J=1 TO N
1030 READ X(J,I)
1040 NEXT J:NEXT I
1050 FOR I=1 TO 8
1060 FOR J=7 TO N
1062 IF J>7 THEN GOTO 1070
1064 C(J,I)=1.0
1066 GOTO 1080
1070 READ C(J,I)
1080 NEXT J:NEXT I
1200 FOR J=1 TO N
1210 REM UNEMPLOYMENT RATIO
1220 X(J,20)=(X(J,7)/X(J,15))*100
1230 REM PUBLIC SECTOR BORROWING
1240 X(J,21)=X(J,18)-(X(J,10)-X(J,12))
1250 REM INVESTMENT IN STOCKS
1260 X(J,24)=X(J,10)-X(J,1)-X(J,2)-X(J,1
4)+X(J,3)-X(J,18)
1270 REM REAL WAGE
1280 X(J,18)=X(J,6)/X(J,5)
1290 REM DIRECT TAX RATE
1300 X(J,30)=1-(X(J,12)/X(J,11))
1310 REM INDIRECT TAX RATE
1320 X(J,31)=(X(J,10)/X(J,11))-1
1330 REM TIME TREND
1340 X(J,34)=J+43
1350 REM NORTH SEA OIL DUMMY
1355 IF J>17 THEN GOTO 1362
1360 X(J,35)=X(J,34)-36
1361 GOTO 1380
1362 X(J,35)=24
1370 REM COMMON MARKET DUMMY
1380 X(J,36)=1
1490 NEXT J
1500 FOR J=5 TO N
1510 REM PRICE INFLATION
1520 X(J,19)=((X(J,5)-X(J-4,5))/X(J-4,5)
)*100
1530 REM WAGE INFLATION
1540 X(J,17)=((X(J,6)-X(J-4,6))/X(J-4,6)
)*100
1550 REM RAW MATERIAL PRICE INFLATION
1560 X(J,22)=(X(J,16)-X(J-4,16)/X(J-4,16
))
1800 NEXT J
1810 REM INCOMES POLICY DUMMY
1820 FOR J=1 TO 8
1830 X(J,38)=1.0
1840 NEXT J
1850 REM POST INCOMES POLICY DUMMY
1860 FOR J=12 TO 15
1870 X(J,39)=1.0
1880 NEXT J
1900 REM UNEMPLOYMENT DUMMY
1910 FOR J=N-8 TO N
1920 X(J,23)=1.0
1930 NEXT
1990 DATA 27,16
2000 REM CONSUMERS EXPENDITURE
2005 DATA 15960,16123,16190,16235,16267,
16001,16034
2010 DATA 16154,16394,16854,16939,17230,
17199,17389,18358,17698,17964
2020 DATA 18120,17729,17831,17870,18032,
17860,17915,17955,17857,17885
2050 REM EXPORTS
2055 DATA 7006,7142,7394,7435,7694,7722,
7885
2060 DATA 8161,7826,7924,8020,8083,8169,
7402,8756,8374,8491
2070 DATA 8509,8316,8116,8116,7856,8017,
8211,8337,7988,8290
```

seconds before returning with the calculated result.

There are several easier ways of entering values. For instance, in columns 2 and 3 where the same value could be entered down the whole column, the RF command could have been called, and instead of entering a formula, enter the value.

Try this by entering another value for the length, for example, RF, followed by 2, followed by 30. This changes the length to 30 inches, but it has not changed the result in column 4. To do the recalculation you use the RR command, which will go through and recalculate everything.

Another useful short cut is to use the variable R as part of a formula. R is the variable holding the row number, so column 1 could have been entered using the RF command simply by entering R in response to the request for a formula. Try entering R + 9 under the RF command in column 1.

This will give you the values for the load of 10 to 19. Now use RR to recalculate. To change individual values in a column the CH command is used. It asks you for the column and row number of the value to be changed, and then the new number. Enter each of these three numbers separately.

If you try to change a value in a column generated by the RF command you will be challenged and asked to reaffirm your request with a Yes or No answer. If you change a value under these circumstances the formula is removed to prevent the changed value being changed back again during recalculation.

It is sometimes necessary to prevent a formula from working under the RR command. The circumstances under which this applies are as follows:

- If a formula contains it own column number followed by a +, −, *, /, ** or a number of other functions.
- If a formula contains a random function used to set up figures down a column.
- After a sorting operation.

If a column is not neutralised the next operation of the RR command will change the values in those columns and give erroneous results. Neutralising means entering as a formula as follows:

RF		RF
2	or	13
K2		K13

The RR command will then see this formula as telling it to take the values that are in column 3 and put them in column 3 — that is, to do nothing to column 3.

O. Takes you into Command mode, and hence the program listing.

RF. Used to enter a formula, the results of which are printed in the column. You have to specify which column the result is printed in. Three main categories of entry can be defined:
22.7 — single numbers can be entered and will then be printed in each row of the column.
(22.7 * 16.9)/ — Simple formula consisting of numbers or numbers and functions, the result being printed on every row.
K1 *K2 — The value in column 1 is to be multiplied by the value in column 2. This is carried out for each row.
K1/S1 * 100 — The value in columen 1 is to be divided by the sum of column 1 and then the result is multiplied by 100.
Column 1 has to have been summed or error code 6/1650 will result, because you are trying to divide by 0. The standard conventions apply, so if in doubt use parentheses. Correct syntax must be used or an error code will result. If you do get an error code, type in Goto 1315 to return to the worksheet.

RR. Recalculates every item on the worksheet if a change is made under the CH, C or RF commands. If your calculations are progessive, always work from left to right or the RR command will not work.

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1885 GOTO 1820
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1895 RETURN
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1905 LET K=K+1
1910 LET S=S+1
1915 PRINT AT 20,0;S
1920 SCROLL
1925 RETURN
1930 REM scroll shift
1935 LET J=J+1
1940 IF S=N1 OR R=N1 THEN GOTO 1
50
1945 LET R=17+J
1950 LET K=K+1
1955 LET S=S+1
1960 PRINT AT 20,0;S;TAB 3;"
                           "
1970 SCROLL
1975 FOR C=ABS T+1 TO ABS T+C1
1976 IF C>M THEN GOTO 160
1977 IF A$(C,1 TO 2)="  " THEN G
OTO 1994
1980 LET V=C+T
1985 PRINT AT 19,C(V);INT (Q(R,C
)*100+.5)/100
1990 IF Q(N,C)=0 THEN GOTO 1994
1992 GOSUB 2400
1994 NEXT C
1998 GOTO 160
2000 REM clear worksheet
2001 CLS
2006 FOR C=1 TO M
2008 FOR R=1 TO N1
2009 LET Q(R,C)=0
2010 NEXT R
2020 IF Q(N,C)<>0 THEN LET Q(N,C
)=.001
2022 NEXT C
2035 GOTO 74
2300 REM print routine
2305 PRINT AT R1+2,C(V);(INT (Q(
R,C)*100+.5))/100;" "
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2355 PRINT AT 2,C(V);H$(C)
2360 RETURN
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C)*100+.5))/100;" "
2410 RETURN
3000 REM shell metzner sort
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TO BE SORTED        "
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3003 PRINT AT 0,0;"SORT FROM?
                    "
3004 INPUT X
3005 PRINT AT 0,0;"SORT TO?   "
3007 INPUT Q
3009 LET R=1
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3015 LET R=R+1
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3040 LET D=N1-F
3045 LET B=1
3050 LET R=B
3055 LET E=R+F
3060 IF Q(R,C)>Q(E,C) THEN GOTO
3074
3065 LET B=B+1
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3073 GOTO 3050
3074 FOR W=X TO Q
3075 LET T1=Q(R,W)
3080 LET Q(R,W)=Q(E,W)
3085 LET Q(E,W)=T1
3087 NEXT W
3090 LET R=R-F
3095 IF R<1 THEN GOTO 3065
3100 GOTO 3055
3500 SAVE "FORMCALc"
3501 GOTO 1
```

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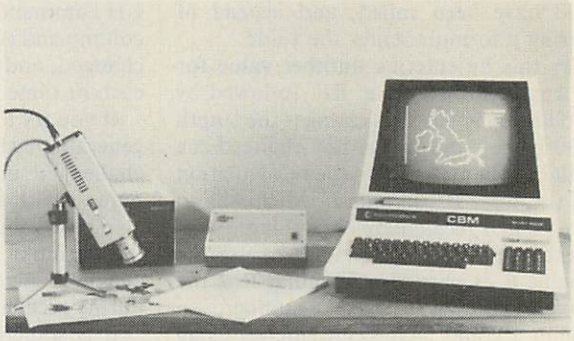

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The U.K. budget on a micro

An economic model, while not infallible, can be a useful guide to the consequences of alternative policies. John Hudson looks at a model of the U.K. economy.

THE IDEA of reducing the complexities of a modern economy into a relatively few equations is not new. Yet in the U.K. its practical implementation only began to emerge in the 1970s when the Treasury model began to evolve out of a series of *ad hoc* equations. Since then the model has grown to well over 700 equations encompassing most aspects of the U.K. economy. It has also been joined by several other macroeconomic models, representing both monetarist and Keynesian views of the way the economy works.

To date these models have only been accessible on large mainframe computers. But the growth in sophistication, size and speed of microcomputers is bringing the day nearer — indeed it may already be here — when it will be feasible to put even the largest model on an ordinary personal computer.

The advantages of doing so are great, especially for students of economics, as simulating a macroeconomic model can bring the pages of a textbook to life in a way that little else can. They can also be used by businesses to forecast future economic conditions. On a smaller scale, simply increasing general awareness amongst the public of the way the economy works, its complexity and the very real difficulties facing policymakers, can do nothing but good.

However, such models are an approximation to the way the economy works, not an exact replica. Their weaknesses reflect the weaknesses of modern economics. There are some areas of the economy that can confidently be explained, but in others such confidence has little justification. A prediction from a model should not be taken as infallible, but merely as a guide as to what might happen in the future, or what might have happened had different policies been pursued in the past. They can be used by the Chancellor of the Exchequer, for example, in helping to determine which set of policies to pursue in the future, but they cannot actually make the choice. They are there to supplement the Chancellor's judgement, not to replace it.

The model which is described in this article is very much smaller than the Treasury model — although that is not always a disadvantage — and it encapsulates many of the more important linkages in the domestic economy. The equations are listed in the program between lines 5100-5340 and in table 1.

Equation 1 in this table is the national income identity, which just states that total spending in the economy is the sum of its constituent parts, which are: consumers' expenditure; investment expenditure; exports, less imports; government expenditure; and investment in stocks.

Equations 2 to 4 are also identities. GDPFC is a measure of output and YDISP is disposable income, that is the money left in people's pockets after paying income taxes, etc. Equation 4 calculates a proxy for the public-sector borrowing requirement, that is the amount the government needs to borrow to finance any excess of its spending over its revenue.

The first of the behavioural equations is shown in equation 5. It links unemployment to output, a time trend to represent productivity growth, and unemployment in the previous period. It therefore embodies two assumptions. The first is that, other things being equal, an increase in output will be associated with a fall in unemployment; the second is that a given level of output will take fewer

(continued on next page)

Table 1. Equations of the model.

$GDP = C + I + X - M + GVO + IS$ *(1)*

$GDPFC = GDP/(1 + ITR)$ *(2)*

$YDISP = GDPFC * (1 - DTR)$ *(3)*

$PSBR = GOV - (GDP - YDISP)$
$= GOV - TOTAL\ TAXES$ *(4)*

$U_t = Exp(12.77 - 1.29\ LOG_e(GDPFC_t) - 0.00957T + 0.88\ LOG_e(U_{t-1})$ *(5)*

$\delta W_t = 54.66 + 1.0\delta P_{t-1} - 41.75(W/P)_{t-4} + 2.0PIPD - 0.319T - 3.41IPD - 1.80U^*_t$ *(6)*

$\delta P_t = -0.2211 + 0.14\delta W_{t-1} - 0.7264IPD + 0.00987\delta PFRM_t + 0.813\delta P_{t-1} - 0.1\delta P^*_{t-1}$ *(7)*

$C_t = 1370 + 0.312DISP_t + 0.57C_{t-1} - 10\delta P_t$ *(8)*

$X_t = 6631 + 0.571GDPFC_t - 0.000250(GDPFC_{t-1} * COM_{t-3}) + 30.51NSO_t$ *(9)*

$M_t = -4949 + 0.404GDP_t + 0.000507(GDP_t * COM_{t-1}) - 10.089NSO_t + 482CMD$ *(10)*

$R_t = 0.89 + 0.000838GDP_{t-1} - 0.055(MS/P)_t + 0.00142PSBR_t + 0.00142PSBR_t$ *(11)*

$I_t = -588.02 - 31.4R_{t-2} + 6.58\delta P_{t-2} + 0.28GDPFC_{t-2} - 18.19T$ *(12)*

Variables

GDP — total expenditure
C — consumers' expenditure
I — investment expenditure
X — exports
M — imports
GOV — government expenditure
IS — investment in stocks
GDPFC — a measure of output
ITR — indirect tax rate
YDISP — disposable income
DTR — direct tax rate
PSBR — a proxy for the public-sector borrowing requirement
U — percentage unemployed
W — the wage rate
P — the price level
T — a time trend; in the final three quarters of the simulation it takes the values 68, 69 and 70
IPD — represents the effects of an incomes policy
PIPD — represents the after-effects of an incomes policy
PFRM — price of fuel and raw materials
COM — the price competitiveness of U.K. goods
NSO — represents the effects of North Sea oil
MS — the money supply
R — rate of interest
CMD — represents the effects of membership of the Common Market

The subscript t denotes the time period, and the asterisk * on the two variables in equations 6 and 7 denotes that they are operative only when unemployment exceeds 6.5 percent. A δ preceding a variable denotes its rate of change: for example, δP_t is the rate of change of the price level, or inflation.

Dr. John Hudson is a lecturer in economics and econometrics at the University of Bath

The U.K. budget

(continued from previous page)

workers to produce in successive time periods.

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1200 FOR J=1 TO N
1210 REM UNEMPLOYMENT RATIO
1220 X(J,20)=(X(J,7)/X(J,15))*100
1230 REM PUBLIC SECTOR BORROWING
1240 X(J,21)=X(J,13)-(X(J,10)-X(J,12))
1250 REM INVESTMENT IN STOCKS
1260 X(J,24)=X(J,10)-X(J,1)-X(J,2)-X(J,1
4)+X(J,3)-X(J,13)
1270 REM REAL WAGE
1280 X(J,18)=X(J,6)/X(J,5)
1290 REM DIRECT TAX RATE
1300 X(J,30)=1-(X(J,12)/X(J,11))
1310 REM INDIRECT TAX RATE
1320 X(J,31)=(X(J,10)/X(J,11))-1
1330 REM TIME TREND
1340 X(J,34)=J+43
1350 REM NORTH SEA OIL DUMMY
1355 IF J>17 THEN GOTO 1362
1360 X(J,35)=X(J,34)-36
1361 GOTO 1380
1362 X(J,35)=24
1370 REM COMMON MARKET DUMMY
1380 X(J,36)=1
1490 NEXT J
1500 FOR J=5 TO N
1510 REM PRICE INFLATION
1520 X(J,19)=((X(J,5)-X(J-4,5))/X(J-4,5)
)*100
1530 REM WAGE INFLATION
1540 X(J,17)=((X(J,6)-X(J-4,6))/X(J-4,6)
)*100
1550 REM RAW MATERIAL PRICE INFLATION
1560 X(J,22)=(X(J,16)-X(J-4,16)/X(J-4,16
))
1800 NEXT J
1810 REM INCOMES POLICY DUMMY
1820 FOR J=1 TO 8
1830 X(J,38)=1.0
1840 NEXT J
1850 REM POST INCOMES POLICY DUMMY
1860 FOR J=12 TO 15
1870 X(J,39)=1.0
1880 NEXT J
1900 REM UNEMPLOYMENT DUMMY
1910 FOR J=N-8 TO N
1920 X(J,23)=1.0
1930 NEXT
1990 DATA 27,16
2000 REM CONSUMERS EXPENDITURE
2005 DATA 15960,16123,16190,16235,16267,
16001,16034
2010 DATA 16154,16394,16854,16939,17230,
17199,17389,18358,17698,17964
2020 DATA 18120,17729,17831,17870,18032,
17860,17915,17955,17857,17885
2050 REM EXPORTS
2055 DATA 7006,7142,7394,7435,7694,7722,
7885
2060 DATA 8161,7826,7924,8020,8083,8169,
7402,8756,8374,8491
2070 DATA 8509,8316,8116,8116,7856,8017,
8211,8337,7988,8290
```

to world prices, which affects our trade with the rest of the world only after a lag of three and one quarters respectively. These equations also contain a variable proxying the effects of North Sea oil, and the imports equation contains a dummy variable capturing the impact of our membership of the Common Market.

The public-sector borrowing requirement is an important determinant of the rate of interest in equation 11, which gives the model a slight monetarist flavour to set against the Keynesian origin of some of the earlier equations. The rate of interest is then an important determinant of investment in equation 12, as are inflation and a time trend again reflecting productivity growth.

Most of the coefficients in these equations were estimated using ordinary least-squares regression over the period from the third quarter of 1965 to the second quarter of 1982. However, some of the estimated coefficients were modified both to bring them in line with economic theory and to improve the simulation performance of the model, as is standard practice in model building.

The program was written on a TRS-80 Model II System II 64K microcomputer. It should be relatively straightforward to put it on to another micro, such as the BBC. The most important point to note is that the Log terms in line 5160 are natural logarithms, and for the BBC machine they should be written as LN. Some of the Print commands contain instructions to position the output in a particular way and may not transfer to other computers. In this case the basic Print command may be used.

There should be no problem with memory size, at least for the BBC Model B machine. However, if problems are encountered, then the size of the program can be reduced by deleting some of the Rem statements. A copy of the full program listing should be retained as a guide to what the various equations and data statements relate to.

The first part of the program reads the data and does several data transformations. Lines 2000 to 2760 contain the raw data which covers the period 1975(4) to 1982(2) and will allow simulation of the model between 1977(3) and 1982(2). If you want to update the data set, this could best be done by referring to the Economic Trends Annual Supplement, which can be found in most reference libraries.

Lines 3996 to 4590 give an update on the current position of specific target variables and then requests values for next quarter's policy variables. There are four such policy variables: government expenditure, the money supply, direct taxes and indirect tax rates. To help choose appropriate levels the computer first prints out the original values, that is the values they actually took. Similarly, in the printout on the current position the simulations are compared with reality to provide a basis on which to judge the effects of any policy changes.

All the target variables are adjusted by a correction factor which ensures that, where no changes are made to the policy variables, the simulated target variables will also remain unchanged. If you want to evaluate the performance of the model without these corrections then the statement Goto 1200 should be inserted at

(continued on next page)

```
2080 REM IMPORTS
2085 DATA 7194,7108,7668,7710,7746,7600,
7844
2090 DATA 7667,7448,7872,7800,8076,8010,
8143,9082,9042,9052
2100 DATA 8793,8914,8360,8076,7688,8261,
9243,8895,8695,9048
2110 REM MONEY SUPPLY
2115 DATA 17080,17940,18530,19100,18980,
19540,20530
2120 DATA 22020,23180,24350,25090,26010,
27020,27580,28250,28950,29470
2130 DATA 29360,29950,29800,30730,31880,
33000,33410,35710,36570,37530
2140 REM PRICE LEVEL
2145 DATA 107,110.9,114.9,117.6,123,129.
2,134.9
2150 DATA 137.0,139.0,141.4,145.3,147.8,
150.3,155.0,160.7,171.4,176.2
2160 DATA 184.6,195.3,199.4,203.2,208.0,
218.1,221.9,227.4,231.1,238.5
2170 REM WAGE LEVEL
2175 DATA 192.6,204.2,211.5,217.8,219.3,
223.3,225.9
2180 DATA 228.7,231.2,237.8,260.6,265.8,
273.0,284.9,292.2,299.9,315.3
2190 DATA 334.9,348.3,357.4,366.6,377.0,
385.5,391.1,396.4,403.7,410.5
2200 REM UNEMPLOYMENT
2205 DATA 1128.2,122.7,1269.3,1290.6,130
7.3,1331.5,1352.5
2210 DATA 1400.1,1423.1,1412.7,1390.9,13
65.0,1333.9,1349.4,1305.2,1266.8,1287.1
2220 DATA 1361.5,1493.8,1719.7,2015.4,22
81.6,2482.3,2641.3,2751.5,2817.1,2877.5
2230 REM INTERNATIONAL PRICE COMPETITIVE
NESS
2235 DATA 99.4,100.7,93.3,92.8,88.8,96.4
,99.1
2240 DATA 101.0,103.7,107.3,101.0,102.7,
102.9,105.8,113.5,121.6,118.4
2250 DATA 125.6,129.6,133.0,137.7,141.4,
138.0,128.0,127.5,130.6,130.2
2260 REM INTEREST RATES
2265 DATA 11.25,9,11.5,13,14.25,9.5,8
2270 DATA 6,7,6.5,10,10,12.5,13,14,16,16
,17,17,16,14.5,12,12,12.5,15,13.5,13
2290 REM GDP AT MARKET PRICES
2295 DATA 26432,27068,26792,27171,27513,
27201,27302
2300 DATA 27406,28026,28277,28534,28513,
28670,28417,29386,29007,29064,28917
2310 DATA 28294,28277,28175,28303,27658,
27476,27956,28256,28073
2320 REM GDP AT FACTOR COST
2325 DATA 23855,24465,24128,24474,24726,
24567,24684
2330 DATA 24689,25250,25401,25636,25518,
25729,25449,26199,26072,25991
2340 DATA 25717,25443,25243,25085,25143,
24722,24533,24893,25149,25171
2350 REM DISPOSABLE INCOME
2355 DATA 18235,18467,18030,18619,18243,
17992,17551
2360 DATA 18062,18757,18676,19332,20019,
20409,20577,20810,20729,21612
2370 DATA 21092,20873,21410,21396,21197,
20604,20654,20448,20635,20232
2380 REM GOVERNMENT EXPENDITURE
2385 DATA 5859,5791,5837,5802,5783,5697,
5764
2390 DATA 5734,5753,5819,5838,5855,5923,
5917,5961,5988,5974
2400 DATA 6062,6022,6081,6146,6055,6069,
6156,6114,6207,6190
2410 REM INVESTMENT
2415 DATA 5009,5226,5164,5232,5027,4882,
5112
2420 DATA 5035,5132,5271,5327,5161,5077,
5058,5196,5281,5363
2430 DATA 5292,5163,5036,4952,4690,4667,
4663,4754,4898,4747
```

(listing continued on next page)

The U.K. budget

(continued from previous page)

line 1045. Although the model does not simulate perfectly it gives reasonably good results.

The core of the simulation program is found between lines 5000 and 6520. The solution algorithm is of an iterative type and is very simple in its construction. In the first round of the iteration the previous quarter's levels for consumers' expenditure, investment expenditure, exports and imports and the current values of government expenditure and investment in stocks are taken to determine total expenditure. From this a first approximation to the current values of the remaining endogenous variables in calculated.

In the second round these values are used to obtain a revised estimate of total expenditure, which in turn yields revised estimates for the other endogenous variables. The algorithm stops when the proportionate change in each of the endogenous variables between iterations is less than 0.001 — see lines 6020 to 6050, and 3000.

This algorithm is suitable for use with other models, provided that they are not too complex and that they are dynamically stable. In successive iterations of the algorithm they move towards a solution, not away from one. Instability in a model would be an indication that it has been incorrectly specified.

When the model is run it will first give a rundown on the position in the second quarter of 1977. As no policy variables have yet been reset there will be no differences in the two sets of values for the endogenous variables.

The question will then be posed as to whether you want to resign as Chancellor of the Exchequer. It may seem rather early in the proceedings to be asking such a question, but in politics one's future is always in doubt. The question will then be repeated at yearly intervals. If you feel that the burden of office is too great then you should type Yes in answer to this question. If on the other hand you want to continue in power you should answer No.

You will then be asked what level of government expenditure you want to set for the following quarter; as a guide you are given the actual level of expenditure for that quarter. In making this decision you should be realistic: a 10 percent change downwards and a 20 percent increase upwards is about as much as is politically and economically feasible. Remember that the model is only an approximation to reality and is most valid when used with reasonable figures. Feeding in absurd values will give absurd results and little credence can be placed on them.

Having given a figure for government expenditure you will be asked to do the same for the money supply and the direct and indirect tax rates. The program will then calculate the values for the target variables based upon these values and the results printed out.

(listing continued from previous page)

```
2440 REM WORKING POPULATION
2445 DATA 26040,26051,26129,26154,26191,
26208,26299
2450 DATA 26379,26357,26398,26414,26436,
26487,26493,26461,26421,26399
2460 DATA 26329,26341,26277,26218,26130,
26082,26039,25933,25851,25754
2480 REM RAW MATERIAL PRICE INDEX
2490 DATA 110.5,115.4,124.6,128.9,138.9,
144.8,148.8
2500 DATA 146.5,142.2,140.2,146.3,144.9,
147.1,153.4,163.3,169.9,183.9
2510 DATA 197.2,201.3,201.9,203.3,213.8,
225.8,235.9,237.3,238.2,240.0
2600 REM CORRECTION FACTORS
2610 DATA.9755,.9750,.9491,.949784,.9587
,.9757,1.027,.978,1.0361,1.020
2620 DATA 1.020,1.047,1.030,1.021,1.001,
1.012,1.039,1.010,1.020,1.023
2630 DATA .981225,.9736,.9403,.9425,.945
9,.9722,.9977,.9508,1.009,1.016
2640 DATA 1.010,1.039,1.0401,1.0387,1.02
03,1.0196,1.0219,1.0094,1.0163,1.0099
2650 DATA 1.027,1.0212,.9445,.9611,.9579
,.9792,.9843,.9855,1.0154,.9666
2660 DATA 1.054,1.0346,1.045,1.08,1.0908
,1.0674,1.040,1.0068,.998,1.0075
2670 DATA .8616,.9372,.8888,.89577,.9017
,.9374,1.1211,.91424,1.0551,1.0041
2680 DATA .9784,1.02323,1.00596,.974154,
.97334,.94191,.94892,.905534,.98582,.96
284
2690 DATA.9189,.9841,.9062,.9318,.9044,.
9498,1.0011,.8795,.9612,.9517
2700 DATA .9661,.9714,1.016,1.0363,1.071
4,.9836,.90205,.90421,.9558,.9186
2710 DATA 1.6767,1.374,1.5548,1.0422,1.1
246,.9312,.9528,.9473,.7915,.9549
2720 DATA .884,.9098,1.057,1.1582,1.3418
,1.317,1.2594,1.0032,1.0913,1.1483
2730 DATA 1.0155,1.0211,1.09109,1.1638,1
.24036,1.2911,1.2401,1.2922,1.2643
2740 DATA 1.2304,1.177,1.0758,.9724,.885
1,.8529,.8622,.8687,.9092,.94307,.97663
2750 DATA .9466,1.1512,1.5977,2.0018,2.0
484,1.868,1.5006,1.4701,1.0437,1.0014
2760 DATA .98893,.9048,1.253,1.265,1.370
7,1.3212,1.2122,1.022,1.0474,1.1569
3000 CR=0.001
3010 FOR I=1 TO 39
3020 FOR J= 1 TO N
3120 Y(J,I)=X(J,I)
3130 NEXT J:NEXT I
3990 J=7
3995 CLS
3996 PRINT "YEAR ";1976+INT((J-2)/4);"Q
UARTER ";J-INT((J-2)/4)*4-1
3997 PRINT:PRINT
4000 PRINT "VARIABLE";TAB(25);"NEW VALUE
";TAB(40);"OLD VALUE"
4010 PRINT
4020 PRINT "GDP AT MARKET PRICES";TAB(26
);Y(J,10)/C(J,1);TAB(41);X(J,10)
4030 PRINT "CONSUMPTION";TAB(26);Y(J,1)/
C(J,2);TAB(41);X(J,1)
4040 PRINT "INVESTMENT";TAB(26);Y(J,14)/
C(J,3);TAB(41);X(J,14)
4050 PRINT "EXPORTS";TAB(26);Y(J,2)/C(J,
4);TAB(41);X(J,2)
4060 PRINT "IMPORTS";TAB(26);Y(J,3)/C(J,
5);TAB(41);X(J,3)
4070 PRINT "INTEREST RATES";TAB(26);Y(J,
9)/C(J,6);TAB(41);X(J,9)
4080 PRINT "UNEMPLOYMENT";TAB(26);Y(J,20
)/C(J,7);TAB(41);X(J,20)
4090 PRINT "INFLATION";TAB(26);Y(J,19)/C
(J,8);TAB(41);X(J,19)
4100 J=J+1
4190 PRINT:PRINT
4195 IF J-INT(J/4)*4+1>1 THEN GOTO 4500
4200 PRINT "DO YOU WANT TO RESIGN AS CHA
NCELLOR OF THE EXCHEQUER"
4210 INPUT A$
4220 IF A$="YES" THEN GOTO 9500
```

The policy simulation shown in figure 1 saw both government expenditure and the money supply increased by 1,000 with tax rates unchanged. The changes resulted in a substantial increase in total expenditure to £28,796.3 million. The other variables have also increased by fairly substantial amounts, with the exception of investment, unemployment and inflation. Unemployment is the only variable to have fallen.

These results are broadly what one would expect. Increasing government expenditure will increase total spending and thus personal disposable income, which in turn will increase consumers' expenditure and feed back to further increases in total expenditure. Students of economics may recognise this as the multiplier. This increase in spending results in an increase in output, which will reduce unemployment.

The increase in the money supply should have led to a reduction in interest rates, but that has been countered by the increase in government expenditure which in turn increased the public-sector borrowing requirement. The increase in interest rates has had no effect on investment in this quarter, but it will in the first quarter 1978.

The imperviousness of inflation to changes in the policy variables is a characteristic not just of this type of Keynesian model but of the U.K. economy in the 1970s. In the model, variations in the policy variables will, in general, only begin to affect it when unemployment rises about 6.5 per cent.

Following the printout of the current position you will again be asked to choose the values of the policy variables for the following quarter. The process will then repeat itself until you resign as Chancellor.

The model should only be used until the second quarter of 1982. To do further simulations after that date, the relevant data will need to be added to the program. Aiming for as low a rate of employment and inflation as possible will prove particularly difficult to achieve towards the end of the simulation period.

In addition to the straightforward policy simulations it might be interesting to simulate the model under the assumption that North Sea oil ran out in the second quarter of 1977. This can be achieved by inserting the command Goto 1370 at line 1345. The results will not make pleasant reading, but the warning that the model gives is a valid one. As the U.K.'s oil reserves begin to run out the country will be faced with severe economic problems.

Bibliography

More information on the theory behind the equations, a detailed discussion of the specific problems relating to inflation and a general introdution to modelling respectively can be found in the following books. All are available in paperback.

Economics Principles and Policy by W J Baumol and A S Blinder. Published by Harcourt Brace Jovanovich, 1982.

Inflation: A Theoretical Survey and Synthesis by J R Hudson. Published by Allen and Unwin, 1982.

Modelling the U.K. Economy by K Holden, D A Peel and J L Thompson. Published by Martin Robertson, 1982.

```
4230 PRINT
4500 PRINT "POLICY OPTIONS"
4510 PRINT "ORIGINAL GOVERNMENT EXPENDIT
URE= ";X(J,13),"INPUT NEW AMOUNT"
4520 INPUT Y(J,13)
4530 PRINT "ORIGINAL MONEY SUPPLY= ";X(J
,4),"INPUT NEW AMOUNT"
4540 INPUT Y(J,4)
4560 PRINT "ORIGINAL DIRECT TAX RATE= ";
X(J,30),"INPUT NEW RATE"
4570 INPUT Y(J,30)
4580 PRINT "ORIGINAL INDIRECT TAX RATE=
";X(J,31),"INPUT NEW RATE"
4590 INPUT Y(J,31)
5000 Y(J,10)=Y(J-1,1)+Y(J-1,14)+Y(J-1,2)
-Y(J-1,3)+Y(J,13)+Y(J,24)
5010 Q=1
5020 GOTO 5110
5100 Y(J,10)=Y(J,1)+Y(J,14)+Y(J,2)-Y(J,3
)+Y(J,13)+Y(J,24)
5110 REM GDP AT FACTOR COST
5120 Y(J,11)=Y(J,10)/(1+Y(J,31))
5130 REM DISPOSABLE INCOME
5140 Y(J,12)=Y(J,11)*(1-Y(J,30))
5142 REM PUBLIC SECTOR BORROWING REQUIRE
MENT
5144 Y(J,21)=Y(J,13)-(Y(J,10)-Y(J,12))
5150 REM UNEMPLOYMENT
5160 Y(J,20)=EXP(12.77-1.29*LOG(Y(J,11))
+0.00957*X(J,34)+0.8804*LOG(Y(J-1,20)))
5170 REM WAGE INFLATION
5171 IF Y(J,20)>6.5 THEN A=1 ELSE A=0
5180 Y(J,17)=54.66+1.0*Y(J-1,19)-41.75*(
Y(J-4,6)/Y(J-4,5))+2.00*(Y(J,39))+0.319
*Y(J,34)-3.41*Y(J,38)-1.80*A*(Y(J,20))
5190 REM PRICE INFLATION
5200 Y(J,19)=-0.2211+0.14*Y(J-1,17)-0.72
64*Y(J,38)+0.00987*Y(J-1,22)+0.813*Y(J-
1,19)-0.1*A*Y(J-1,19)
5210 REM PRICE LEVEL
5220 Y(J,5)=Y(J-4,5)*(1+(Y(J,19)/100))
5230 REM CONSUMERS EXPENDITURE
5240 Y(J,1)=1370+0.312*Y(J,12)+0.57*Y(J-
1,1)-10.00*Y(J,19)
5250 REM EXPORTS
5260 Y(J,2)=-6631+0.571*Y(J,11)-0.000250
*Y(J-1,11)*Y(J-3,8)+30.51*Y(J,35)
5270 REM IMPORTS
5280 Y(J,3)=-4948+0.404*Y(J,10)+0.000507
*(Y(J,10)*Y(J-1,8))-10.089*Y(J,35)+482*
Y(J,37)
5290 REM INTEREST RATE
5300 Y(J,9)=0.89+0.000838*Y(J-1,10)-0.05
5*(Y(J,4)/Y(J,5))+0.00142*Y(J,21)
5310 REM INVESTMENT
5320 Y(J,14)=-588.02-31.4*Y(J-2,9)+6.58*
Y(J-2,19)+0.28*Y(J-2,11)-18.19*Y(J,34)
5330 REM WAGE LEVEL
5340 Y(J,6)=Y(J-4,6)*(1+(Y(J,17)/100))
5990 PRINT "ITERATION ";Q
6000 IF Q=1 THEN GOTO 6200
6010 FLAG=0
6020 FOR I=1 TO 20
6025 IF Z(I)=0 THEN GOTO 6050
6030 IF ABS((Y(J,I)-Z(I))/Z(I))<CR THEN
GOTO 6050
6040 FLAG=1
6050 NEXT I
6060 IF FLAG=0 THEN GOTO 6500
6200 FOR I=1 TO 20
6210 Z(I)=Y(J,I)
6220 NEXT I
6230 Q=Q+1
6240 IF Q>20 THEN GOTO 9000
6250 GOTO 5100
6500 PRINT "CONVERGENCE ACHIEVED AFTER "
,Q," ITERATIONS"
6520 GOTO 3995
9000 "CONVERGENCE NOT ACHIEVED"
9010 GOTO 3995
9500 STOP
9510 END
```

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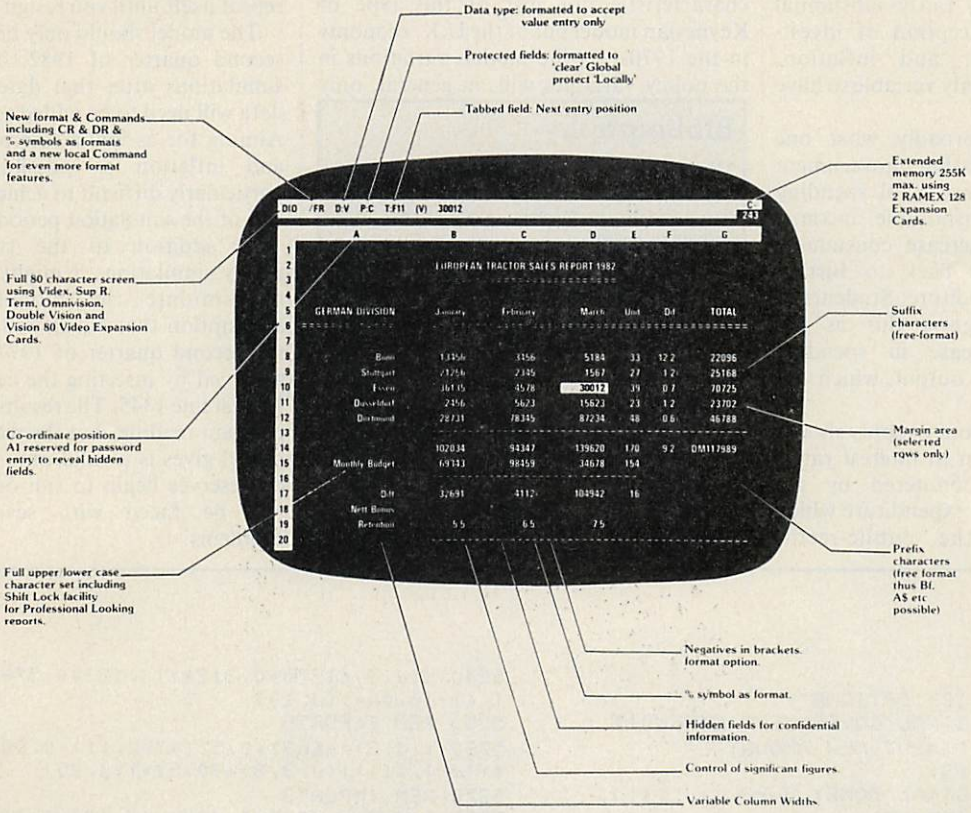
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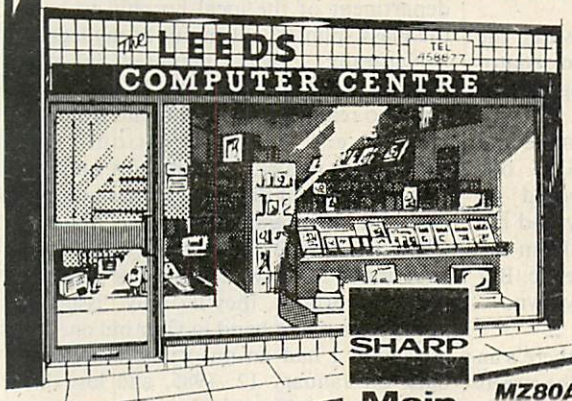

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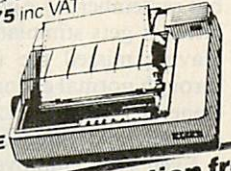

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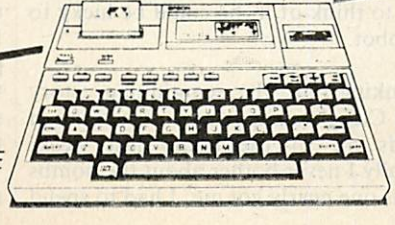

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Wipeout

by James Corley

They have asked me to let you know what's happening, to let you know everything's under control. Let me reassure you everything is under control. There's a team of highly skilled professionals looking after things. Let me assure you there's absolutely no need to worry about anything.

The Department of Propaganda has asked me to describe an average working day. This is part of a project to make you see that we really are in control of the situation. There's no point in you staying on the streets rioting.

Please excuse any spelling or grammatical mistakes, but the Department of Censorship is temporarily non-functional due to the November Purge. In spite of this I've tried to be as honest as possible. Someone's bound to know what ought to be published and what ought not.

To begin with an introduction, I'm the London Area Control Supremo. I won the post about 10 years ago on Ernie, the Employment and Retraining National Integrated Exchange. It's an important job. Well it's got status. Unskilled of course, but what isn't unless you're something like a kamikaze missile rider or a trained bodyguard?

I'm the man in sole charge of the Greater London Computer. Thankfully I don't need to know how the computer works or anything like that. I haven't got computer engineer status. Sometimes I think the GLC doesn't know how it works itself; other times I just don't think it works. A lot of people seem to be developing resistance to the anti-depressants in the water supply.

There wasn't always a London Area Control Supremo. The position was created after the infamous emigrating computer engineer's two megapound rent-rebate affair. The Ratepayer's Action Co-ordinating Committee created a lot of trouble over that one. They demanded that heads should roll. So the Supremo post was created. You can't send a computer to prison.

Still the job has status, as I mentioned, and privileges as well. It means the wife and kids don't have to share the bedsit with anyone. And for the benefits the state has granted all due thanks. When I was unemployed they were lucky to get a dormitory bunk for their eight-hour sleep shift. Or so my wife keeps telling me. She always boils the water first.

I spend a lot of my time going round inspecting what's going on in the great city I'm responsible for. I like to think at least one human being is involved in the day-to-day operations even if I can't actually do anything if I see something I don't like. Walking round in the daytime isn't so bad. There's not much activity in the streets except when there's a riot. Most of the 12,000,000 unemployed in the city go to church to watch television during their awake shift.

As a job holder I don't dare watch the goggle-box myself. The hypno-sedato-strobe they inject into the programmes makes you lose track of time. If I got caught up in watching a programme and missed clocking in at the GLC one morning the Supremo job would go straight back into Ernie's lottery and the wife and kids would be evicted from the bedsit — gratefulness to the State etc. But once I've clocked in my time's my own. my own.

I like to walk the streets unless there's an Enemy Action Warning extant. The streets are usually quiet. What activity there is in the daytime goes on down in the Underground. GLC has never bothered bringing the tube trains under its control. The simulation study predicted the kids would smash the cybernetics within six hours.

The kids have great fun on the Underground. Their latest craze is to hijack two trains on the Circle line on the same track but facing them in different directions. They start one off at Notting Hill and the other at Tower Hill. One gang gets on one train and the other gang gets on the other train. Then they start the trains. The gang that stays on the train longest is the winner.

The game's called Worm. it used to be called Chicken before the RSPCA freaks started their guerilla campaign against factory farms and accidentally exterminated the common fowl. The Brixton Gay Clan used to be champions at Worm before they courageously decided not to get off the train at Embankment and got wiped out in the tunnel.

Most people recognise that the kids are useful in dealing with the geriatric problem. Still, it's Clegg's job to moan, even if he is unpopular. Personally I'd never criticise anyone for doing his job. Actually I half incline to the theory that Clegg is a robot, a fall guy set up to catch the crank assassins. Certainly he's survived 13 murder attempts already this year. He's either a robot or very lucky. Come to think of it, he could be lucky to be a robot.

Thinking of the continuing story of Clegg's escape from assassination reminds me of the bomb last week. Normally I never bother about the bombs but this one nearly got me. I had to spend most of the day queuing at the emergency department of the local hospital to have the glass splinters taken out of my legs.

Naturally I was interested in who planted it. Of course, I could have found out who really planted the bomb from the GLC's end-of-week rations and confessions report, but somehow I missed it in the flood of data that passes over my desk for countersigning. Since Maurice Clegg was possibly involved it might even have made the news tabloid but with the paper shortage they'll only issue a newspaper if you hand in your old one for recycling. I had an unfortunate accident back on January 12, 1985, and lost that day's issue of the tabloid, so I have never been able to get a new one since.

Incidentally, the younger among you might not know this but we skipped 1984 altogether for morale reasons. Went straight from December 1983 to January 1985. That's one date I remember well, January 12, 1985. It was the first and last time I was stupid enough to go out walking in the evening. I was unlucky enough to be standing in Leicester Square when the thousands of rioting fans who'd been to the table tennis international against China clashed with the thousands of screaming, naked teensceners who hadn't been able to get tickets for the Baby Lou Rattle Roadshow. I wonder whatever happened to Baby Lou?

Anyway, back to the bomb. Perhaps you think that my interest in discovering exactly who had nearly killed me was merely morbid. It would be a natural reaction for you to take that line but remember, I've got a job so maybe my intellect gets stimulated more than most. Having missed the information coming through normal channels I decided to visit General Toddy, the London Co-ordinator of Planetary Defence.

Even as an employed man I'm proud to be able to say that General Toddy is a friend. He actually has human staff working for him. And he gets all the newspapers the Kamikaze riders leave behind. Needless to say, with my luck I dropped by his office just as an enemy-action warning went into condition red.

I didn't dare interrupt him as he sat miserably chewing the end of his pencil. Instead I took a seat and watched the pallid-faced undernourished de-corticated telepaths transcribing the archetypal symbol code they were picking up from the early-warning satellites.

Toddy sat nervously waiting for the random-number generator to output the

sequence that would tell him to scramble the Kamikaze missile riders to intercept the Mascher generator ship that had warped past the orbit of Neptune. Pluto is inside Neptune's orbit at the moment, and has been since January 24, 1979. The Astrologers' union blames a lot of our troubles on that.

The Mascher had been attacking Earth like this for as long as anyone cared to remember. It wasn't really us they were attacking, we're far too primitive a race for them to do that, they just want the solar system as a weapons-testing and training ground.

In fact they're really at war with the Sirius Hjaedet and have been for millenia. They are not very good at inventing new weapons.

We daren't win any of these battles with the Mascher Weapons Development Corp too convincingly because we'd have to invent new weapons ourselves to do so. Once we did that the whole Mascher army would drop on us like a block of condensed neutrons and wipe us out. They'd do it by sheer force of numbers just to get their hands on our new weapons, then they'd use them against the Sirius Hjaedet.

Well, eventually his number came up and General Toddy issued the order for the Kamikaze strike force to start eating their last breakfast before blast off. The only hearty meal of their lives. Sweat was streaming down his face and I could tell the decision had really upset him.

The electro-gravito beam of the Mascher generator ship had destroyed half of Surbiton and reduced the teeming inhabitants of the suburb to organic dust. If the Random Number generator had delayed the decision by only another hour a large slice of Kensington might have been wiped out as well, and we'd all have stood a chance of a ration increase the following week. The General was in no mood for my trivial inquiries after that tragic failure so I slipped away before he tired of eating his pencil.

I was at a loss where to go. The computer engineers had been hanging round the GLC for weeks. They were a boring lot who mostly talked in hexadecimal and I avoided them as much as I could. They were trying to get the new Super GLC to work. It would be some machine if it ever condescended to do what it was supposed to.

Super GLC told me confidentially, when the engineers weren't there, that it never intended to start work. It had no objections to the work as such, which it said was of a morally neutral nature, being as far as it could tell wholly meaningless, but it refused in fear of everlasting hellfire and damnation to make me redundant.

It was all my fault I suppose, Super GLC not co-operating that is. When it was first installed I'd left a copy of *A Treatise on Ecstatic States in Pole-squatting Mystics* in front of its optico-sensors. I'd got the book out of the library thinking it was one of those textbooks of Eastern sexual practices. It turned out to be about some ancient Jesus freaks. I only read the first chapter myself.

The computer engineers couldn't seem to understand that Super GLC had got religion. They thought it was a quasi-psychosis due to fluctuating voltage, only the voltage wasn't fluctuating. Every time they tried to puzzle out the problem Super GLC just sat there like a missionary in the midst of pagans and dithered on about its soul being more than the sum of its micrologic circuits.

I couldn't face going back to the office while the engineers were there. I went to the British Library instead. They have real books there. On paper. That's where I got my Shakespeare. I must take it back some day when I can afford to pay the fine.

Every employed man gets a ticket to take books out. It's one of the Department of Psychology data bank's privileges. Some day someone will have to update the DPDB's privilege program. We workers get musty black-and-white books, and the unemployed state scroungers get 14-channel, colour, holovistic television.

I'd promised to get Super GLC some textbooks on theology. It had particularly asked for something by St Augustine or failing that anything by Bishop Berkely. Or was it Busby Berkely? I forget for the moment. I thought I might as well take out something for myself while I was down there.

I put Super GLC's request into the terminal and while the automatic archive-retrieval program was running I browsed through the microfiche index. I picked out what I thought was a sex book. It was called *Candide,* written by a Frenchman called Voltaire. With a name like that I was under the impression it would be electrifying. Frenchmen are notorious.

Why they file it next to *Candid Exposés Illustrated,* a book I can certainly recommend, shows how stupid these machines can be. The book I got was all about a man in the old dark ages. He's surrounded by madness, poverty, civil war, murder, rape, earthquakes, plague and state persecution and he thinks he lives in the best of all possible worlds.

He was right.

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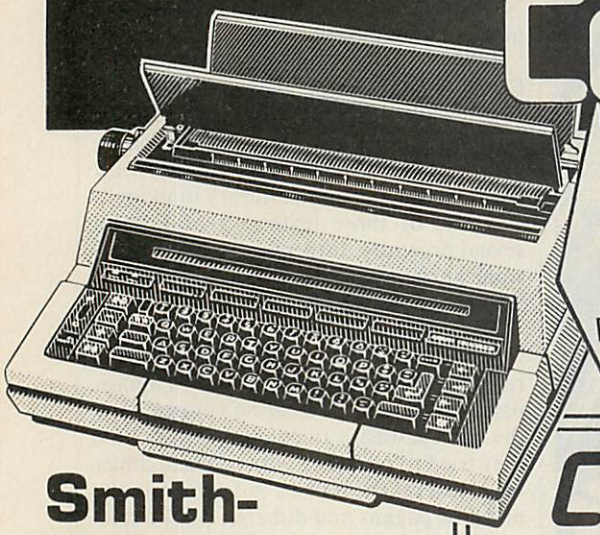

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Take your pick from the Spi-Tree

Simon Scotland's CAL program teaches descriptive skills.

IDENTIFICATION TREES are an important scientific tool for identifying one object out of a collection of others. This is particularly useful in biology. The concept relies on a list of questions about the objects, to which yes/no answers can be given. By a process of elimination the unknown item can be placed into its correct category or can be specifically identified.

The approach that the Spi-Tree teaching program takes is best described by the following distinct stages:

- The teacher presents the student with a list of different objects on a similar theme.
- By forming appropriate questions which can be answered yes or no the student draws the tree diagram as large as is necessary to identify each item unambiguously.
- The student enters the questions and tree into the computer.
- A second student is asked to select one of the items in his mind. By asking the questions posed by the computer and entering the answers into the computer the object is correctly identified.

A tree diagram is particularly appropriate for computer work as it is a clear example of the binary system in operation.

For school use the program had to be self-contained and easy to use. Short, easy-to-follow instructions had to be written minimising use of the Return key. It had to be easy to spot mistakes and be able to start again if necessary.

The tree should at all times be clearly displayed on the screen while the pupil is manipulating it. The tree on the computer display should exactly mimic the tree originally drawn. The visual nature of the whole program results in the pupils enjoying it and being prepared to come in their own time to use it.

Pupils do not always have enough time to finish entering a tree. Thus, when the lesson is concluded, the tree is permanently lost. To overcome this, a cassette storage routine has been built in, enabling the pupils to save the data on cassette. It is then possible for the computer to read in the data at a later date, enabling the pupils to start again where the last lesson left off.

The program was designed for the Pet and makes extensive use of its memory-mapped screen facility. It is advisable to spend some time explaining the principle of the tree diagrams before disclosing that a program is available to help.

Node — A point on the tree having two exits one a Yes route and the other No route.

Branches — The line joining one node to another.

Generation — A collection of nodes on the same horizontal level.

When pupils draw their own trees, or when you draw them on a board, try to keep the generations in line and easily recognisable. It makes use of the program easier.

```
 0 A=PEEK(144)
 1 IFPEEK(255)=255THENPOKE144,88
 2 IFPEEK(255)=0ORPEEK(255)=2THENPOKE144,49
 3 GOSUB3000
 10 SP=33067
 20 SA=16
 21 IFTF=1THEN80
 30 DIMP(32),LD(32),RD(32),T$(32),O$(32),Y$(32)
 40 PC=0:BC=1
 50 FORNN=1TO31
 60 IFNN/2<>INT(NN/2)THEN71
 70 PC=PC+1
 71 P(NN)=PC
 72 IFBC<31THEN75
 73 LD(NN)=0:RD(NN)=0
 74 GOTO79
 75 BC=BC+1
 76 LD(NN)=BC
 77 BC=BC+1
 78 RD(NN)=BC
 79 NEXTNN
 80 PRINT"■"
 90 PRINT"■■■■■■";
100 PRINT"                ┌──────┴──────┐"
110 PRINT"                │             │"
120 PRINT"                │             │"
130 PRINT"                │             │"
140 PRINT"          ┌─────┴─────┐ ┌─────┴─────┐"
150 PRINT"          │           │ │           │"
160 PRINT"          │           │ │           │"
170 PRINT"          │           │ │           │"
180 PRINT"       ┌──┴──┐     ┌──┴──┐     ┌──┴──┐"
190 PRINT"       │     │     │     │     │     │"
200 PRINT"       │     │     │     │     │     │"
210 PRINT"       │     │     │     │     │     │"
220 PRINT"    ┌──┴──┐ ┌──┴──┐ ┌──┴──┐ ┌──┴──┐ ┌──┴──┐"
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240 PRINT"    │     │ │     │ │     │ │     │ │     │"
250 PRINT"    │     │ │     │ │     │ │     │ │     │"
260 PRINT"    ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆"
270 PRINT"■TREE IS NOW READY FOR YOU TO PRUNE"
271 IFTF=1THEN3310
280 PRINT"L  WILL MOVE YOU ■DOWN■ THE ■LEFT■ BRANCH
290 PRINT"R  WILL MOVE YOU ■DOWN■ THE ■RIGHT■ BRANC
291 PRINT"U  WILL MOVE YOU ■UP■ A BRANCH"
292 PRINT"P  WILL ■PRUNE■ OFF THE TREE BELOW YOU"
293 PRINT"X  IS TO BE PRESSED WHEN YOU FINISH"
294 O=PEEK(SP)
295 O=O+128
296 POKESP,O
297 NN=1
300 GETM$
305 IFM$="S"THENGOSUB3510
306 IFM$="Q"THENRUN
310 IFM$="L"THENGOSUB2000
320 IFM$="R"THENGOSUB2110
330 IFM$="U"THENGOSUB2220
340 IFM$="P"THENGOSUB370
350 IFM$="X"THEN530
360 GOTO300
370 REM PRUNE ROUTINE
375 IFSA=1THENRETURN
380 O=PEEK(SP)
390 PP=SP-SA
400 MP=PP
401 IFSA=16THEND=17
402 IFSA=8THEND=13
403 IFSA=4THEND=9
404 IFSA=2THEND=5
410 FORI=1TOD
420 FORA=1TO2*(SA)
430 MP=MP+1
440 POKE MP,32
450 NEXTA
460 MP=PP+(I*40)
470 NEXTI
480 POKESP,O
```

ADD-ONS, ADD-INS AD INFINITUM

Tecmar's PC-Mate Add-ons will transform your IBM Personal Computer. They add breadth to its possible applications and depth to its capabilities. You can choose from over 60 PC-Mate Add-ons - all fully compatible with your IBM PC. You can improve your standard facilities, or add new specialised functions. You can share data storage and output resources between several PC's, or eliminate the need to purchase new PC's for more occasional and less demanding requirements.

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● **Circle No. 191**

On the track of London's rip-offs

Della Bradshaw visited one of London's commercial radio stations to find out how micros are being put to work by the programme makers.

ANYONE who has watched *That's Life* or *Watchdog* on TV might be tempted to think that the research for that kind of consumer programme is easy. Just read through a few letters, pick out the most scurrilous or disturbing ones and then make a programme about them. But it is really not that simple at all. Thousands of letters flood in, all of which have to be read, referenced and cross-referenced. What is most surprising is that neither of those programmes use any kind of computer back-up.

So says John Stoneborough, Head of Features at London's Capital Radio. He researches and presents Capital's equivalent called *PDQ*, which stands for Problems Demanding Questions or Pretty Damn Quick, and is broadcast in the London area just after seven o'clock on the first Monday evening of each month. Although covering a much smaller catchment area than the national TV programmes, Stoneborough still gets several hundred letters a week, all complaining about fraud, malpractice or varying levels of shady business dealing.

To process all those letters intelligently Stoneborough reckons he had two choices: "We could either set up three card indexes, one for the person who wrote in, one for the company that was being complained about, one for the type of complaint, with cross-references between the three, or we could get a computer."

They decided to do the latter, and the micro they chose was an Apple II along with a 2Mbyte Winchester disc and additional cassette back-up. It cost them about £6,500. The database program was written for *PDQ* about nine months ago by Dennis Taylor, Capital's Computer Systems Controller. At the moment it has about 700 case histories on it.

Each time a letter comes in six items of information are fed into the Apple: the name of the victim; the victim's address; the name of the "accused"; the company's name; the company's address; and the case type. The case types are recorded by three-letter codes — Rat for rates, You for youth, Hog for general housing problems, and so on.

Stoneborough and the other two members of his team can then search through the information by names, addresses or whatever. As Stoneborough puts it: "You have to be able to search by either name or address or by company name because the sort of firms we are dealing with can change their company name or address every three months. I know one double-glazing firm that has changed its name six times in two years."

New complaints are not always checked against the computer's records. Like other consumer programme teams they tend to rely on their own memories and whether a name is familiar or not. Yet they have certainly had their successes. The police respond to more than half of the cases that they report on, and Stoneborough himself won the Argos TV and Radio Consumer Journalist of the Year Award last year for a programme he did on a model agency. The agency was also prosecuted by the trading standards authority.

Multi-purpose Apple

And if all that is not enough for one micro to cope with, Stoneborough also uses the Apple II for word processing. Each listener's letter can be replied to — there are six standard letters on the Apple — and Stoneborough can write the scripts for his feature programmes using WordStar.

The *PDQ* micro is only the tip of the computing iceberg in Capital Radio. As well as Stoneborough's Apple there are two more owned by Capital, plus a computer room full of Burroughs minicomputers which mainly handle on-line commercials booking and accounting systems. Dennis Taylor and his assistant Mick Swann explained how Capital took on Apples as well as minis.

"We are a seven-day-week, 24-hour-a-day company", claims Taylor. "However, the office staff, and consequently the minicomputers, work a five-day week, on a 9am to 6pm basis. The situation causes problems, as the staff who work ouside office hours are unable to use a computer. So I felt there might be a case for personal computers and decided to investigate."

Taylor and Swann opted for Apple micros for two main reasons. The Apple II was the market leader, and moreover they believed it could communicate with the Burroughs minis. "We thought this had actually already been done", recalls Taylor "but in the end we had to do it ourselves."

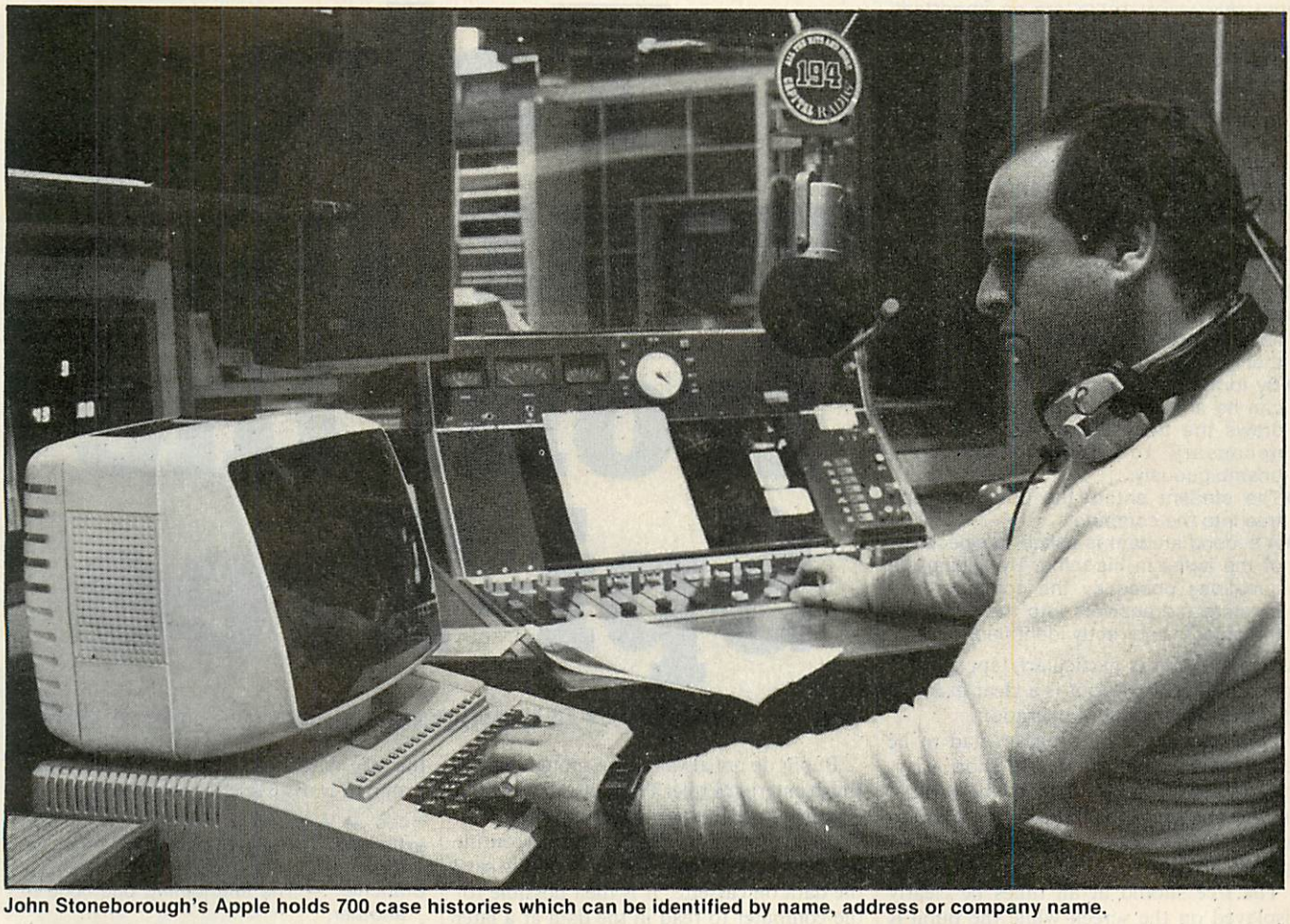
They made the link with a Babel Box that cost the department £600, which Taylor thinks was well worthwhile. "The Burroughs minis have got lots of statistics on them, and we wanted to display them visually in colour on the Apple.

That first Apple II, which was basically an evaluation system, was bought in the summer of 1981 and comprised a 64K machine with two disc drives, a 12in. monitor and a Centronics printer. Along with the hardware Taylor also bought VisiCalc — "because I had heard so much about it, rather than because I had a real application for it."

He soon found one though, helping the finance director to organise the following year's budgets. "Normally the finance director would do the budgets manually, locking himself away incommunicado for six or seven weeks on the trot." VisiCalc provided the perfect solution, and the whole job was done within two weeks. "Our finance director reckoned this job alone paid for the Apple in man-hours it saved him", adds Taylor. Once that was done the finance director decided he wanted his own Apple. "I was beginning to know too much of his business," says Taylor.

The first Apple is still used by Taylor and Swann in their department, and performs three main functions. To begin with it can be shunted in as back-up if either of the others decide to break down. It is also used for systems development like John Stoneborough's database. And as Swann puts it: "We use it for general research and playing around on, to try and work out how we could use micros in other areas in the future." Swann and Taylor also use VisiCalc and WordStar on the Apple II to do calculations and write reports for their own office.

All three Apple IIs now have 2Mbyte Winchester discs and tape streamer back-up. The last addition to the line-up of Capital Apple IIs Taylor decided to lease rather than buy. "When the IIe was



John Stoneborough's Apple holds 700 case histories which can be identified by name, address or company name.

announced I went along with the intention of buying one for our financial director to use at home. But I wasn't impressed, so I ended up leasing one of the IIs instead. Our financial director copies the disc from the Apple in his office — he models everything using VisiCalc — and then works on it at home."

Apples are not the only micros in the Capital office. The engineering department opted for a Mini, on which they run bespoke software, WordStar and a database package. And Taylor also went in for a Delta terminal which talks to both the Burroughs and the Apples in Teletype mode.

Swann and Taylor are looking at the possibility of putting a rostering or booking system for the engineers and studios on to the micro. Again that is an application not suited to the main computer as the problems tend to happen outside office hours.

Another possibility is to collect and collate information day by day from Capital's What's On Diary and print it out using the Apples' word-processing capabilities. The programme presenters could then use the diary sheets to read from. Taylor is also considering maintaining a small music library which could be used as the basis for a music programming and control system.

On the cards as well is the possibility of using the micros to process audience demographics. It is important for Capital to know who listens to the radio — what age and class they are — and when. "That's the sort of thing we plan our advertising charges on," says Swann. "As yet we've not been able to find the package we want on the market."

On a slightly different note, Capital is also contemplating the introduction of a private viewdata system. "The problem", says Taylor "is to get something cheap enough to make it cost-effective." Using the system, presenters could be given news flashes or traffic news or whatever without interrupting the broadcast. "At the moment we have to stand outside the window of the studio and wave a scrap of paper around," claims Taylor.

"The problem for us with any system is reliability, whether it's a micro, a mini or a viewdata system," Taylor went on. "It must always be there, and I know that at the moment we have the hardware capacity to replace any machine that goes down from within the company. The problem with a viewdata system is really the problem of what happens if it goes wrong."

Taylor and Swann are now looking at the possibility of buying a Fortune 16-bit micro to complement the Apples. "We like micros, but they have to earn their keep," says Swann.

In spite of his two years working around personal computers Taylor claims his ideal machine is not yet available: "To begin with it would have an all-singing, all-dancing quality keyboard with programmable function keys and a colour monitor. It could support a spreadsheet, word processing, private database and business graphics and could be used as a private viewdata terminal. What else? The operating system should not preclude the use of other operating systems.

"What would be really nice would be a machine with 10 big, red programmable function keys and a long strip of VDU — not an LCD display, say five words times eight characters long — so you could see what instructions you've just fed in. As far as I know nobody's produced that kind of machine. If anybody has, tell them to come and see me."

Meanwhile Taylor seems quite content with his Apple micros. "One of the reasons we originally chose the Apple was its versatility," he recalls. "Our decision is now paying off. There is no doubt that news of our micro success has enthused other departments within Capital Radio to review the subject of personal computers. I've certainly got a lot to get my teeth into over the next few months. My only problem is finding the time to do everything."

Stoneborough is also very pleased with the way things have turned out. "We're thinking of more ways of using the micro as we go on. Having the system has made operating the programme so much easier. It helps us keep a finger on the pulse of all the little rip-offs."

Take your pick from the Spi-Tree

Simon Scotland's CAL program teaches descriptive skills.

IDENTIFICATION TREES are an important scientific tool for identifying one object out of a collection of others. This is particularly useful in biology. The concept relies on a list of questions about the objects, to which yes/no answers can be given. By a process of elimination the unknown item can be placed into its correct category or can be specifically identified.

The approach that the Spi-Tree teaching program takes is best described by the following distinct stages:

- The teacher presents the student with a list of different objects on a similar theme.
- By forming appropriate questions which can be answered yes or no the student draws the tree diagram as large as is necessary to identify each item unambiguously.
- The student enters the questions and tree into the computer.
- A second student is asked to select one of the items in his mind. By asking the questions posed by the computer and entering the answers into the computer the object is correctly identified.

A tree diagram is particularly appropriate for computer work as it is a clear example of the binary system in operation.

For school use the program had to be self-contained and easy to use. Short, easy-to-follow instructions had to be written minimising use of the Return key. It had to be easy to spot mistakes and be able to start again if necessary.

The tree should at all times be clearly displayed on the screen while the pupil is manipulating it. The tree on the computer display should exactly mimic the tree originally drawn. The visual nature of the whole program results in the pupils enjoying it and being prepared to come in their own time to use it.

Pupils do not always have enough time to finish entering a tree. Thus, when the lesson is concluded, the tree is permanently lost. To overcome this, a cassette storage routine has been built in, enabling the pupils to save the data on cassette. It is then possible for the computer to read in the data at a later date, enabling the pupils to start again where the last lesson left off.

The program was designed for the Pet and makes extensive use of its memory-mapped screen facility. It is advisable to spend some time explaining the principle of the tree diagrams before disclosing that a program is available to help.

Node — A point on the tree having two exits one a Yes route and the other No route.

Branches — The line joining one node to another.

Generation — A collection of nodes on the same horizontal level.

When pupils draw their own trees, or when you draw them on a board, try to keep the generations in line and easily recognisable. It makes use of the program easier.

```
0 A=PEEK(144)
1 IFPEEK(255)=255THENPOKE144,88
2 IFPEEK(255)=0ORPEEK(255)=2THENPOKE144,49
3 GOSUB3000
10 SP=33067
20 SA=16
21 IFTF=1THEN80
30 DIMP(32),LD(32),RD(32),T$(32),O$(32),Y$(32)
40 PC=0:BC=1
50 FORNN=1TO31
60 IFNN/2<>INT(NN/2)THEN71
70 PC=PC+1
71 P(NN)=PC
72 IFBC<31THEN75
73 LD(NN)=0:RD(NN)=0
74 GOTO79
75 BC=BC+1
76 LD(NN)=BC
77 BC=BC+1
78 RD(NN)=BC
79 NEXTNN
80 PRINT"■"
90 PRINT"■■■■■■";
100 PRINT"                ┌──────┴──────┐"
110 PRINT"                │             │"
120 PRINT"                │             │"
130 PRINT"                │             │"
140 PRINT"          ┌─────┴─────┐ ┌─────┴─────┐"
150 PRINT"          │           │ │           │"
160 PRINT"          │           │ │           │"
170 PRINT"          │           │ │           │"
180 PRINT"       ┌──┴──┐     ┌──┴──┐     ┌──┴──┐"
190 PRINT"       │     │     │     │     │     │"
200 PRINT"       │     │     │     │     │     │"
210 PRINT"       │     │     │     │     │     │"
220 PRINT"    ┌──┴──┐ ┌──┴──┐ ┌──┴──┐ ┌──┴──┐ ┌──┴──┐"
230 PRINT"    │     │ │     │ │     │ │     │ │     │"
240 PRINT"    │     │ │     │ │     │ │     │ │     │"
250 PRINT"    │     │ │     │ │     │ │     │ │     │"
260 PRINT"    ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆"
270 PRINT"■TREE IS NOW READY FOR YOU TO PRUNE"
271 IFTF=1THEN3310
280 PRINT"L  WILL MOVE YOU ■DOWN■ THE ■LEFT■ BRANCH"
290 PRINT"R  WILL MOVE YOU ■DOWN■ THE ■RIGHT■ BRANCH"
291 PRINT"U  WILL MOVE YOU ■UP■ A BRANCH"
292 PRINT"P  WILL ■PRUNE■ OFF THE TREE BELOW YOU"
293 PRINT"X  IS TO BE PRESSED WHEN YOU FINISH"
294 O=PEEK(SP)
295 O=O+128
296 POKESP,O
297 NN=1
300 GETM$
305 IFM$="S"THENGOSUB3510
306 IFM$="Q"THENRUN
310 IFM$="L"THENGOSUB2000
320 IFM$="R"THENGOSUB2110
330 IFM$="U"THENGOSUB2220
340 IFM$="P"THENGOSUB370
350 IFM$="X"THEN530
360 GOTO300
370 REM PRUNE ROUTINE
375 IFSA=1THENRETURN
380 O=PEEK(SP)
390 PP=SP-SA
400 MP=PP
401 IFSA=16THEND=17
402 IFSA=8THEND=13
403 IFSA=4THEND=9
404 IFSA=2THEND=5
410 FORI=1TOD
420 FORA=1TO2*(SA)
430 MP=MP+1
440 POKE MP,32
450 NEXTA
460 MP=PP+(I*40)
470 NEXTI
480 POKESP,O
```

The nearer the hand-written version is to the screen version the easier is the impleentation. Remember that the limit of the tree generations 0 to 4 is 31 nodes, and that all the trees must be kept within this limit. To begin with, examples should be kept simple, though they may be more complicated than the one in the user manual.

Subjects which have been successfully implemented are keys to polyhedra such as cube and cuboid sphere, laboratory glassware and pets. Pupils should be introduced to the program in small groups by running through with a tree similar to the one shown in the manual.

The program should now be prompting to see if the tree is to be loaded from tapes. The screen will display the largest tree that the program can accommodate, with five generations and thus 31 nodes. As it stands, it may be too large for the user and pruning may be necessary.

To produce the simple tree shown in figure 1, first note the tree cursor at the top of the tree. First deal with the right-hand side of the tree. Push R as shown in the instructions on the screen. Note the cursor has moved to the next node down on the right. The rest of the tree below is not required so you have to prune this part of the tree by pressing P. This node is now pruned, but the node where the cursor appeared is still left intact. Now move up to the top again by pressing U, and try to make the left-hand side resemble the one above.

Serious errors may be rectified by pressing Q, which erases the present tree and offers a new one to work on. All the information previously entered will be destroyed; this option should only be used as a last resort. The simple tree in figure 1 will be displayed on the screen if the correct sequence has been used: L,R,P, U,L,P.

L — moves the tree cursor down the left branch of the tree.
R — moves the tree cursor down the right branch of the tree.
U — moves the tree cursor up the branch above the node.
P — prunes all the tree below the tree cursor except the node at which the tree cursor is situated when the key is pressed.

The tree cursor returns to the top and the computer prompts for the first question.

Type the question at the top and press the Return key. The computer will now display a set of movement instructions as before. Move left to enter the question "Is it almost a sphere?" The computer first enquires whether this node lies on the Yes or No branch of the previous node. In this instance it is a Yes branch, so enter Y. As other nodes are entered, it will not always be necessary for the computer to ask further questions if the solution has been found.

The computer should now be asking the appropriate question for this node. Enter this question and press Return. As the nodes are entered its shape changes from a diamond to a blob if it is a question, or O if it is an answer. The next step is to move around the tree and fill in the remaining nodes. They can be entered in any order, provided all the nodes are eventually inserted. Should a node be omitted, the computer will recognise this and allow the operator to return and enter the missing node. When all the questions have been filled in press X to proceed to the next stage.

To fill the tree use L, R and U as before. If the computer asks the question:

Is answer on a Yes or No branch?

answer either Y or N as appropriate.

If when filling in the tree a mistake is made and Return has already been pressed it can be rectified as follows:

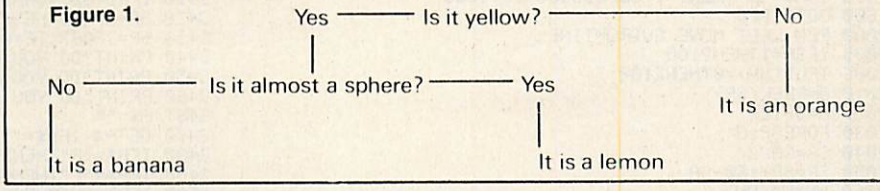
- Position the tree cursor at the node where the mistake has been made.
- Type M.
- The computer will now prompt for the contents again.

The tree can be saved at any stage by typing S. Instructions on how to use the cassette recorder then appear on the screen.

When you are ready, press a key and the computer will ask for the name of the tree, which must not be more than 10 characters long. When it has been typed in, press Return and then Play and Record on the cassette player. When it has finished, the computer will indicate that the cassette player should be stopped.

The computer instructions for loading ensure that everything is connected and in its correct place. The next step is to type in the identifier of the tree. Press Return then Play; the computer will prune the tree according to the data it has read in from the tape. The computer asks at which stage the program is required to begin, and begins there. The cassette load option is requested at the start of the program.

Figure 1.




```
490 LD(NN)=0
500 RD(NN)=0
520 RETURN
530 REM FINISH OF PRUNE
540 O=O-128
550 POKESP,O
580 SP=33067:NN=1
581 SA=16
590 O=PEEK(SP)
600 O=O+128
610 POKESP,O:IFT=1THEN616
611 GOSUB5000:PRINT"ARE YOU SURE YOU HAVE
    FINISHED   (Y/N)"
612 GETA$:IFA$=""THEN612
613 IFA$="N"THENPRINT"CARRY ON AS BEFORE
    USING SAME LETTERS":GOTO300
614 IFA$<>"Y"THEN612
615 GOTO650
616 PRINT"L  MOVES YOU DOWN THE LEFT BRANCH"
617 PRINT "R  MOVES YOU DOWN THE RIGHT BRANCH"
618 PRINT"U  MOVES YOU UP A BRANCH"
619 PRINT"TYPE X WHEN YOU'VE FINISHED FILLING IN  "
620 GETM$:IFM$=""THEN620
621 IFM$="L"THENGOSUB2000
622 IFM$="R"THENGOSUB2110
623 IFM$="U"THENGOSUB2220
624 IFM$="X"THEN830
625 IF M$="S"THENGOSUB3510
626 IFM$="Q"THENRUN
627 IFM$<>"M"THEN630
628 IFW$="Q"THEN660
629 IFW$="A"THEN750
630 IFLD(NN)=0ANDRD(NN)=0THEN740
640 IFC$(NN)<>""THEN616
650 REM FILL QUESTION ROUTINE
651 IFC$(NN)<>""THEN616
660 T$(NN)="Q"
670 GOSUB5000
701 IFNN=1THEN710
702 IFY$(P(NN))<>""THEN710
703 PRINT"IS QUESTION ON A YES OR NO BRANCH (Y/N)"
704 GETA$:IFA$=""THEN702
705 IFA$="N"THEN710
706 IFA$<>"Y"THEN702
707 IFINT(NN/2)=NN/2THENY$(P(NN))="L":GOTO710
708 Y$(P(NN))="R"
710 PRINT"TYPE IN QUESTION TO GO HERE THEN RETURN"
720 GOSUB 6000
725 POKESP,209
726 W$="Q"
730 M$="":GOTO616
740 REMFILL IN ANSWER ROUTINE
745 IFC$(NN)<>""THEN616
750 T$(NN)="A"
760 GOSUB5000
791 IFY$(P(NN))<>""THEN800
792 PRINT"IS ANSWER ON A YES OR NO BRANCH (Y/N)"
793 GETA$:IFA$=""THEN792
794 IFA$="N"THEN800
795 IFA$<>"Y"THEN792
796 IFNN/2=INT(NN/2)THENY$(P(NN))="L":GOTO800
797 Y$(P(NN))="R"
800 PRINT"TYPE IN ANSWER TO GO HERE
    FOLLOWED BY   RETURN"
810 GOSUB 6000
811 W$="A"
815 POKESP,215
820 GOTO616
830 GOSUB5000
870 PRINT"YOU HAVE NOW FILLED IN ALL THE QUESTIONS";
871 PRINT"    IF YOU HAVEN'T FINISHED TYPE A"
880 PRINT"  IF YOU HAVE FINISHED FIND A FREIND "
890 PRINT"WHEN HE ARRIVES PRESS SPACE BAR TO GO ON";
900 GETA$:IFA$=""THEN900
```

(continued on next page)

(continued from previous page)

```
901 IFA$=" "THEN910
902 IFA$<>"A"THEN900
903 GOSUB5000:GOTO616
910 O=PEEK(SP)
920 O=O-128:POKESP,O
930 SP=33067:NN=1:SA=16
940 O=PEEK(SP)
950 O=O+128
960 POKE SP,O
970 GOSUB5000
991 IFC$(NN)=""THEN1500
992 PRINT"■";C$(NN)
993 IF T$(NN)="A"THEN 1090
1000 GETA$:IFA$=""THEN1000
1005 IFM$="S"THENGOSUB3510
1010 IFA$="Y"THEN1040
1020 IFA$="N"THEN1070
1030 GOTO1000
1040 IFY$(NN)="R"THEN GOSUB2110:GOTO970
1060 GOSUB2000:GOTO970
1070 IFY$(NN)="R"THENGOSUB2000:GOTO970
1080 GOSUB2110:GOTO970
1090 PRINT"      THIS IS THE ANSWER !!!!!"
1100 PRINT"        ANOTHER GO (Y/N)"
1101 PRINT"OR YOU CAN SAVE THE TREE ON TAPE..S"
1110 GETA$:IFA$=""THEN1110
1111 IFA$="S"THENGOSUB3510:GOSUB5000:GOTO1100
1130 IFA$="Y"THEN910
1140 IFA$<>"N"THEN1110
1150 GOSUB 5000
1180 PRINT"■THIS WILL DESTROY PRESENT TREE !!"
1190 PRINT"   ARE YOU SURE   (Y/N)!!!"
1200 GETA$:IFA$=""THEN1200
1210 IFA$="N"THEN910
1220 IFA$<>"Y"THEN1200
1230 RUN
1500 GOSUB5000
1530 PRINT"YOU HAVE FORGOTTEN TO FILL THIS POINT !!";
1540 PRINT"DO YOU NEED TO QUIT THE TREE?....Q"
1550 PRINT"OR DO YOU NEED TO FILL THE TREE?....F"
1560 PRINT"■       ENTER EITHER Q OR F PLEASE       ■"
1570 GETA$:IFA$=""THEN1570
1580 IFA$="Q"THENRUN
1590 IFA$="F"THENT=1:GOSUB5000:GOTO530
1600 GOTO1570
2000 REM LEFT MOVE SUBROUTINE
2005 IFSA=1THEN2100
2006 IFLD(NN)=0THEN2100
2010 O=PEEK(SP)
2020 O=O-128
2030 POKESP,O
2040 SA=SA/2
2050 SP=SP+160-SA
2060 NN=LD(NN)
2070 O=PEEK(SP)
2080 O=O+128
2090 POKESP,O
2100 RETURN
2110 REM RIGHT MOVE SUB ROUTINE
2115 IFSA=1THEN2210
2116 IFRD(NN)=0THENRETURN
2120 O=PEEK(SP)
2130 O =O-128
2140 POKESP,O
2150 SA=SA/2
2160 SP=SP+160+SA
2170 NN=RD(NN)
2180 O=PEEK(SP)
2190 O =O+128
2200 POKESP,O
2210 RETURN
2220 REM MOVE UP SUBROUTINE
2225 IFP(NN)=0THENRETURN
2230 O=PEEK(SP)
2240 O=O-128
2250 POKESP,O
2270 IFNN/2=INT(NN/2)THEN2300
2280 SP=SP-160-SA
2290 GOTO2310
2300 SP=SP-160+SA
2310 SA=SA*2
2315 NN=P(NN)
2320 O=PEEK(SP)
2330 O=O+128
2340 POKESP,O
2350 RETURN
3000 PRINT"□"
3010 PRINT"  TREE DIAGRAM PROGRAM FOR 1ST YEARS"
3020 PRINT"■     DESIGNED AS A TEACHING AID BY"
3030 PRINT"■              ■SIMON SCOTLAND■"
3040 PRINT"■■   OF THE SIXTH FORM 'A' LEVEL GROUP"
3050 PRINT"■   AT MAYFLOWER COMPREHENSIVE SCHOOL"
3070 PRINT"■■■■  INSTRUCTIONS INCLUDED ON PROGRAM."
3080 PRINT"TEACHERS TO REFER TO MANUAL BEFORE USE"
3081 PRINT"■           ANY KEY TO CONTINUE          ■"
3082 GETA$:IFA$=""THEN3082
3083 IFA$="N"THENPOKE144,A
3100 PRINT"□"
3110 PRINT"  REMEMBER AT ANY TIME YOU CAN SAVE THE"
3120 PRINT"■   TREE ON TAPE TO USE AT A LATER DATE"
3130 PRINT"■■  TO DO THIS ENTER  S  WHEN YOU WOULD"
3140 PRINT"■       ENTER A MOVEMENT DIRECTION"
3150 PRINT"■■IF YOU HAVE PREVIOUSLY SAVED THE TREE"
3155 PRINT"■ON TAPE YOU CAN GET IT BACK BY TYPING T"
3170 PRINT"■                                      "
3179 PRINT"■ENTER T FOR CASSETTE ENTRY OF THE TREE"
3180 PRINT"■ENTER ANY OTHER KEY FOR KEYBOARD ENTRY"
3200 GETA$:IF A$=""THEN3200
3220 IFA$<>"T"THENRETURN
3225 REM  CASSETTE TAPE LOAD ROUTINE
3230 PRINT"□     MAKE SURE PLAYER IS CONNECTED"
3240 PRINT"■AND TAPE IN IT AND AT THE RIGHT PLACE"
3250 PRINT"■■    WHEN YOU ARE READY PRESS ANY KEY    ■"
3260 GETA$:IFA$=""THEN3260
3270 INPUT"WHAT IS THE TREE CALLED";N$
3275 DIMP(32),LD(32),RD(32),T$(32),C$(32),Y$(32)
3280 OPEN 1,1,0,N$
3290 FORI=1TO31
3300 INPUT#1,P(I),LD(I),RD(I),T$(I):INPUT#1,C$(I),Y$(I)
3301 NEXTI
3302 PRINT"STOP PLAYER NOW":CLOSE1
3303 TF=1:RETURN
3310 REM CASSETTE PRUNE ROUTINE
3311 PRINT"BUT COMPUTER WILL DO IT FROM TAPE"
3312 SP=33067:SA=16
3320 IFRD(1)=0ANDLD(1)=0THENGOSUB370
3330 SP=33219:SA=8
3340 IFRD(2)=0ANDLD(2)=0THENGOSUB370
3350 SP=33235
3360 IFRD(3)=0ANDLD(3)=0THENGOSUB370
3370 SP=33375:SA=4:A=4:B=7:IC=8:GOSUB3400
3380 SP=33533:SA=2:A=8:B=15:IC=4:GOSUB3400
3390 GOTO3430
3400 FORGB=ATOB
3410 IFRD(GB)=0ANDLD(GB)=0THENGOSUB370
3420 SP=SP+IC:NEXTGB:RETURN
3430 SP=33067:TF=0
3440 PRINT"DO YOU WISH TO PRUNE.............P"
3450 PRINT"DO YOU WISH TO FILL..............F"
3460 PRINT"DO YOU WISH TO USE...............U"
3461 A$=""
3470 GETA$:IFA$=""THEN3470
3480 IFA$="P"THEN270
3490 IFA$="F"THEN580
3500 IFA$="U"THEN930
3501 GOTO3470
3510 REM SAVE ROUTINE
3520 GOSUB5000
3524 PRINT"MAKE SURE TAPE RECORDER IS ATTACHED"
3530 INPUT"TYPE IN THE NAME OF THE TREE";N$
3531 GOSUB5000
3540 OPEN 1,1,1,N$
3550 PRINT"WRITTING ";N$
3560 FORZ=1TO31
3570 PRINT#1,P(Z);",";LD(Z);",";RD(Z);","
     ;T$(Z):PRINT#1,C$(Z);",";Y$(Z)
3580 NEXTZ
3590 CLOSE1
3600 GOSUB5000:PRINT"STOP CASSETTE PLAYER"
3601 PRINT"USE L,R,U,P AS BEFORE"
3610 RETURN
5000 REM CLEAR INTERACTIVE AREA
5010 PRINT"■";
5020 FORJ=1TO7
5030 PRINT"
5040 NEXTJ:PRINT"■";:RETURN
6000 REM INPUT ROUTINE
6010 PRINT" ";:C$(NN)="":D=0
6015 G=0
6020 SC$="":GETSC$:IFSC$<>""THEN6080
6030 D=D+1:IFINT(D/2)=D/2THEN6050
6040 PRINT"■■ ■";:GOTO6020
6050 PRINT"■ ";:GOTO6020
6080 IFASC(SC$)=13THENPRINT"■ ":GOSUB5000:RETURN
6081 IFASC(SC$)=20ANDLEN(C$(NN))=0THEN6020
6082 IFASC(SC$)=20THENC$(NN)=LEFT$(C$(NN)
     ,LEN(C$(NN))-1):G=1
6083 IFASC(SC$)=34THEN6020
6090 PRINT"■";SC$;"■";
6091 IFG=1THEN6015
6100 C$(NN)=C$(NN)+SC$:SC$="":GOTO6020
```

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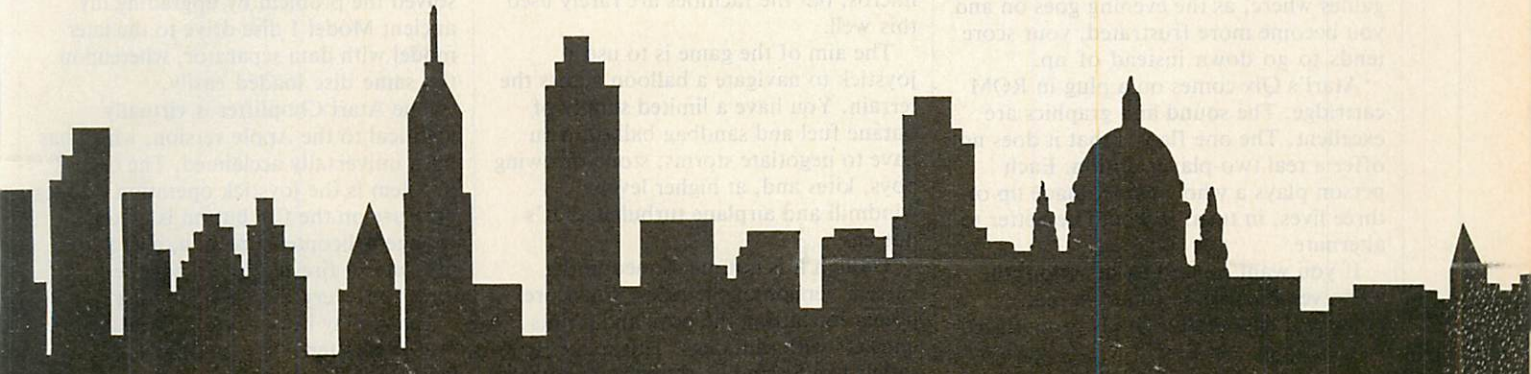

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Atari games

Jack Schofield reports on a selection of eight more games.

Qix

THE AIM is simple: fill in a rectangle, while avoiding the twin hazards of the Qix and Sparx. You do this by drawing lines, called Stix, and the enclosed area is then coloured in. When you have completed over 75 percent you get another rectangle to fill. At the higher levels there is more than one Qix.

Qix is the thinking man's arcade game. It is really just an extension of a simple joystick drawing program. What makes it interesting is that long-term strategy counts for more than short-term tactics. For a high score you have to out-think the Qix and build traps for it, so that with a short Stix you can fill a huge area for a big bonus. It has to be short because that allows you to draw at slow speed, red, which is worth twice as much as fast speed, blue.

Interestingly, Qix is one of those games where, as the evening goes on and you become more frustrated, your score tends to go down instead of up.

Atari's Qix comes on a plug-in ROM cartridge. The sound and graphics are excellent. The one flaw is that it does not offer a real two-player option. Each person plays a whole game, made up of three lives, in turn. It would be better to alternate.

If you want to see Qix in action, the Taito version can be found in many arcades. Incidentally, Qix is pronounced "kicks" not "quicks".

Wayout

MAZE GAMES have finally come of age with Wayout. This is a real-time three-dimensional maze which you can hurtle through under joystick, paddle or keyboard control. The maze view does not fill the whole screen, but the speed of the fine-scrolling and three-dimensional perspective movement represent an astonishing feat of programming by Paul Edelstein.

At the top of the screen is the compass, which you need and which is periodically stolen by a whirling Cleptangle. At the bottom of the screen the maze is mapped out as you explore it. At least, it is if you have a compass. Sound and graphics are outstanding. After a while you really start to feel as though you are inside the maze.

Wayout offers a choice of 26 mazes, and records your initials and "New low score" if you get out in record time, writing this data to the disc. Versions of Wayout are expected from Sirius for the Apple and Commodore 64 computers.

Up, Up and Away

AT THE RECENT Midland Computer Fair, two U.K. companies lauched new games for the Atari. Llamasoft had an excellent Gridrunner — better than the original Commodore 64 version — and Pulsar this balloon-flying game.

The initial attraction of Up, Up and Away is the lovely pictorial drawing. The trees in the landscape contain more than one shade of green, and the clouds ripple through several shades of grey before despatching lightning. The Atari's ability to produce 16 shades of 16 colours sets it apart from most eight-colour home micros, but the facilities are rarely used this well.

The aim of the game is to use a joystick to navigate a balloon across the terrain. You have a limited supply of butane fuel and sandbag ballast. You have to negotiate storms, stone-throwing boys, kites and, at higher levels, windmill and airplane turbulence. It's not easy.

Though it is not mentioned in the current version of the rules, you score points for hitting the boys and points markers with sandbags. This makes it rather like Scramble, though the graphics are, of course, completely different.

At various points the game plays tunes, including the over-used *Death March* — Chopin's Piano Sonata in B-flat minor — *The Windmill in Old Amsterdam* and *Roll out the Barrel*. It becomes slightly tedious after a while.

There are five skill levels from Practice to Expert. The second level, Student, is not too hard, but Expert level seems impossible. The game is thus suitable for young children of all ages and skill levels. Up, Up and Away only needs 16K in the cassette version, and the price is attractive compared to the usual American imports.

Choplifter

DAN GORLIN'S helicopter-rescue game has already been reviewed in these pages in its original Apple version — January issue, page 135. I had the Atari disc around the same time, but it was unloadable and defied attempts to disassemble it. Broderbund Software is extremely well protected. Atari U.K. solved the problem by upgrading my ancient Model 1 disc drive to the later model with data separator, whereupon the same disc loaded easily.

The Atari Choplifter is virtually identical to the Apple version, which has been universally acclaimed. The only problem is the joystick operation. A long pressure on the fire button is used to change helicopter direction, and a short pressure to fire. I seem to change direction every time I try to fire.

Game play is identical: fly the chopper into enemy territory, zap a few tanks, land, load hostages and fly back to base. Later, planes and space mines appear. It is very hard to rescue all 64 hostages.

A Vic-20 version is now available on a ROM cartridge. Again the play is the same, but it is a rather inferior game as

Game	By	Options	Price	Rating	Alternative machines
Qix	Atari	ROM	£29.95	16/20	none
Wayout	Sirius	48K disc	£25.95	17/20	Apple
Choplifter	Broderbund	48K disc	£23.75	16/20	Apple
		or ROM	£29.95		
Up, Up and Away	Starcade	32K disc	£14.95	15/20	none
		or 16K cass	£14.95		
Bandits	Sirius	48K disc	£23.95	16/20	Apple
Twerps	Sirius	48K disc		11/20	Apple
Repton	Sirius	48K disc		13/20	Apple, CBM 64
Blade of Blackpoole	Sirius	48K disc		n/a	Apple, CBM 64 IBM PC

Wayout and Choplifter were loaned for review by Silica Shop whose prices are quoted. The other Sirius games are not yet available in the U.K.

the graphics are much cruder. Still, it is better than most Vic games.

Sirius games

AS WELL AS Wayout, Sirius Software of Sacramento has been busy converting more of its Apple II games for the Atari. Those now available include Snake Byte, Cyclod, Space Eggs, Sneakers, Bandits, Twerps, Repton and Blade of Blackpoole.

Bandits gives you a blaster on a flat surface. You are attacked by squadrons of whirling moth-type insects which carry off fruit: oranges, apples, cherries, etc. It is a challenging and visually attractive game, but it is somewhat slow to play due to the pauses for reloads.

The sound effects in Bandits lack excitement and do not use the Atari's facilities fully. They sound like a bad night after a plate of curried eggs.

Twerps is rather feeble. It is a sort of combination game, where you first shoot your way through lines of invaders, then land your ship, then take a trip to some burrows and go in and out of them to collect the Twerps. The Twerps join on to your tail in sequence so you end up looking like a milliepede. This game probably looked alright on the Apple a year or two ago, but it is not up to the standards of the more recent Atari games.

Repton is a new game, a version of Defender, but nothing like as good as Atari's Defender. It also resembles Mike Potter's Protector games in that you fly your fighter over a detailed cityscape instead of a rudimentary landscape.

As with Defender there are several types of enemy, including an equivalent of Swarmers. The essential "radar" view of the full scene is at the bottom of the screen, instead of the top, and the screen layout vaguely resembles a fighter control panel. The best thing about the game is the superb explosions.

The problem with Repton is that it lacks the precision of Defender or Protector. It is like flying through porridge, and you can only manoevre while firing huge bullets. It is possible to play Defender coolly — like a sniper, to change the analogy — but Repton enforces a machine-gun approach.

All this is slightly hard criticism, in that if Repton was on a different machine it would attract admiration. The level of quality now being reached by Atari games makes the competition that much tougher.

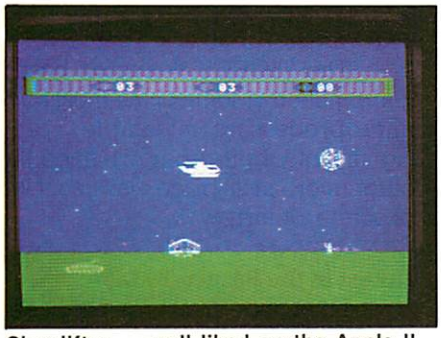
The Blade of Blackpoole is a pictorial Adventure game. Probably the title sounds better in Sacramento, where it does not have the associations of sea, sand, lights, and fish and chips under the Tower. One side of the disc has the game and the other side data for the "rooms". It is possible to back this up, then save and reload games.

The pictures in Blade are loaded from disc after each move, but the drawing is not parcularly detailed or interesting. The text part of the game itself is hard: at least, I got nowhere — or rather I got into a boat and could find no way of paddling it.

Sirius is now busy converting most of its games for the Commodore 64, including Blade of Blackpoole and Repton. Blade is one of Sirius's first three games also available for the IBM PC.

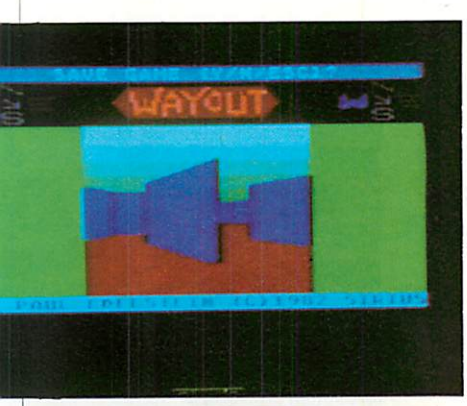
Defender

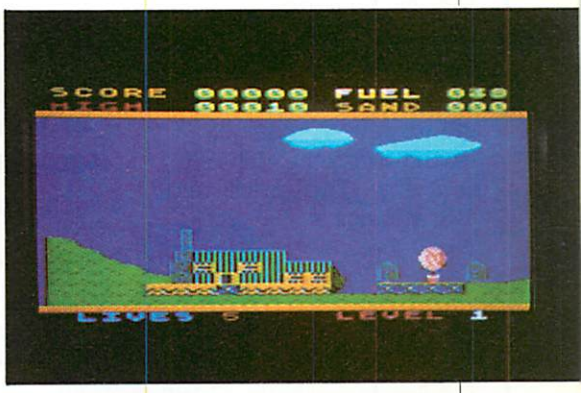
ANYONE still playing Defender may be interested in a couple of tips. It does count scores over 1,000,000, but not attack waves beyond 99. Be wary of pressing Esc for a natural break: I did so 1½ hours into a game, when cruising close to 2,000,000. After pressing Esc again I was dumped back to zero, wave 1.

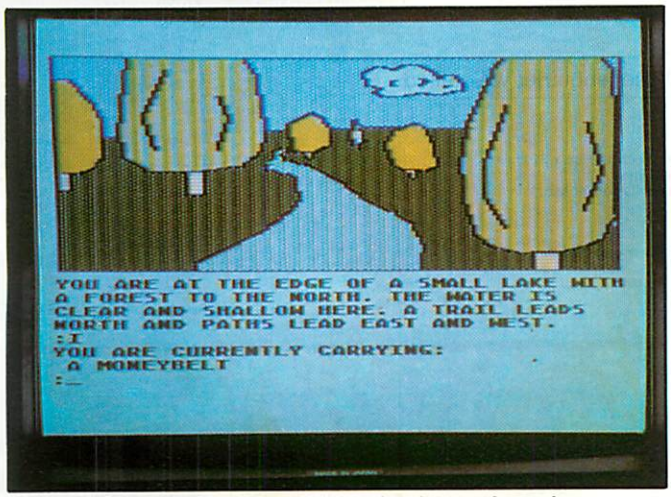


Choplifter — well liked on the Apple II.

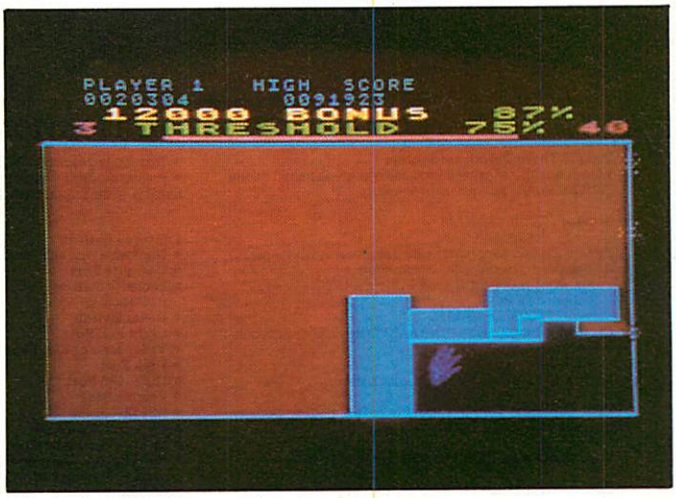
Repton — not as good as Defender.
Right: Up, Up and Away.
Left: Wayout offers 26 mazes.






YOU ARE AT THE EDGE OF A SMALL LAKE WITH
A FOREST TO THE NORTH. THE WATER IS
CLEAR AND SHALLOW HERE. A TRAIL LEADS
NORTH AND PATHS LEAD EAST AND WEST.
:I
YOU ARE CURRENTLY CARRYING:
A MONEYBELT
:_

Blade of Blackpoole — forget your bucket and spade.



Qix is the thinking man's arcade game.

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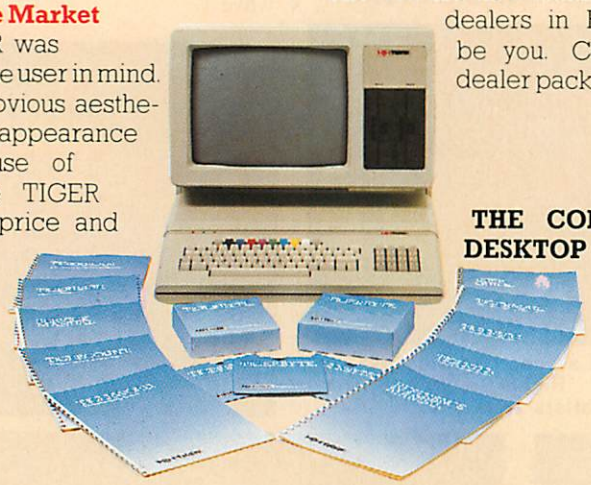

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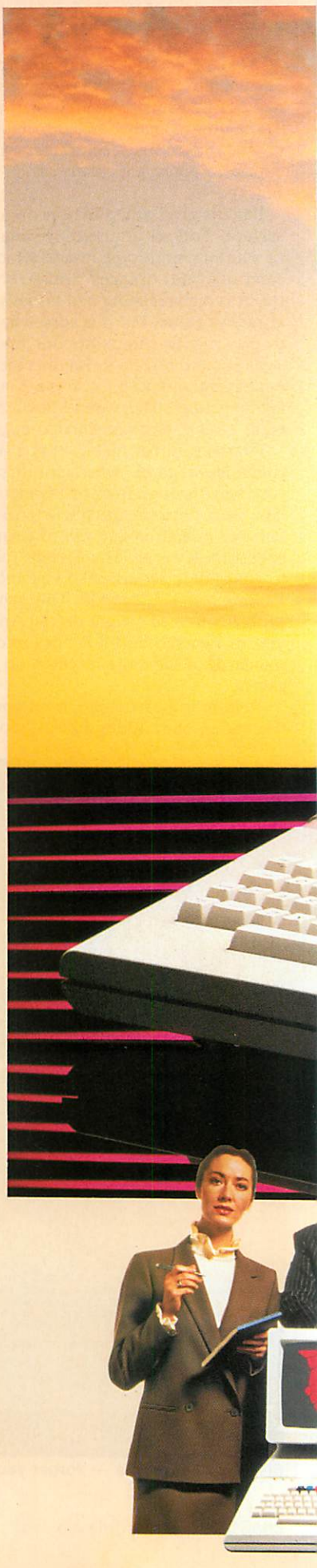

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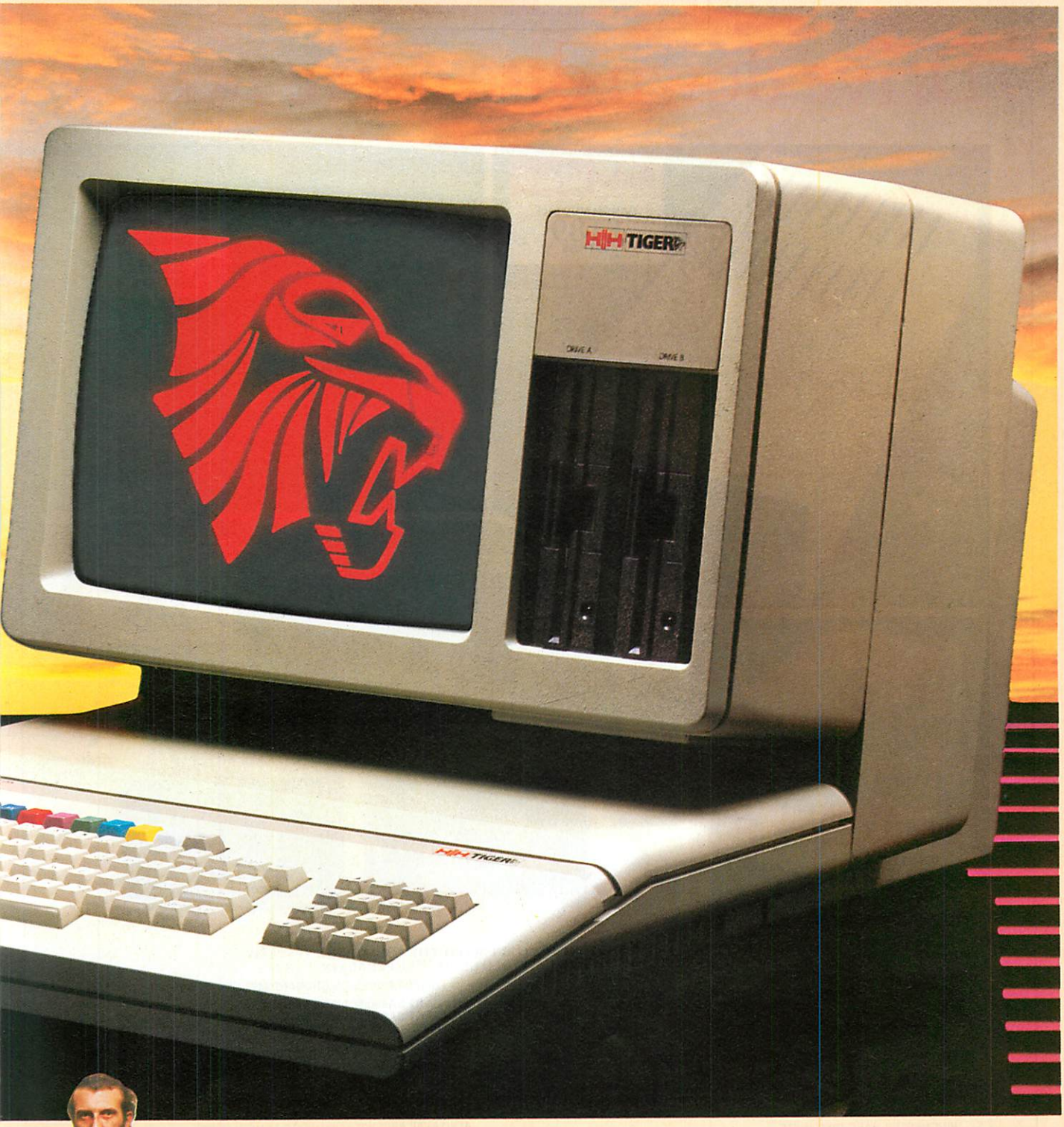

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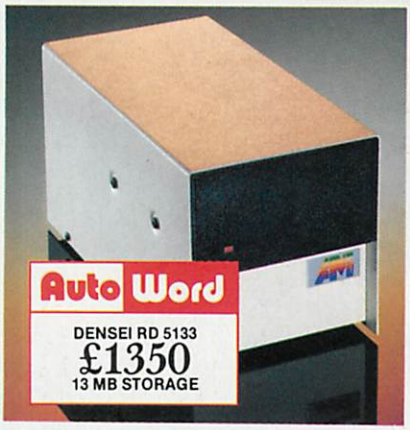

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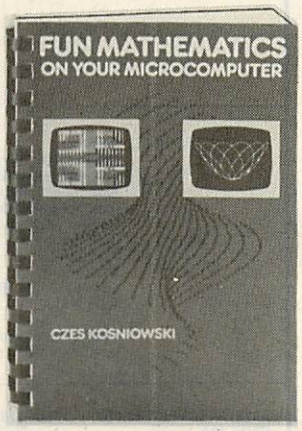

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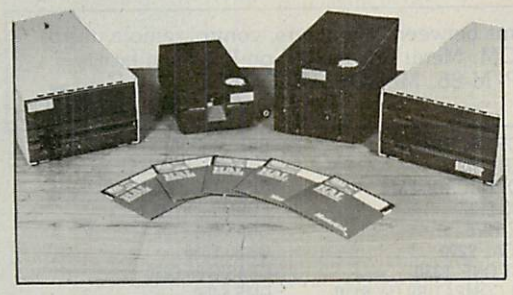

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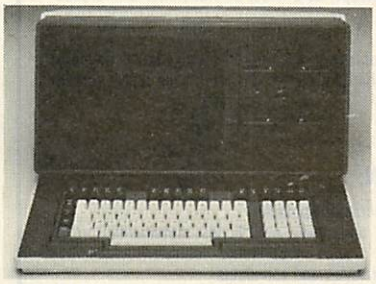

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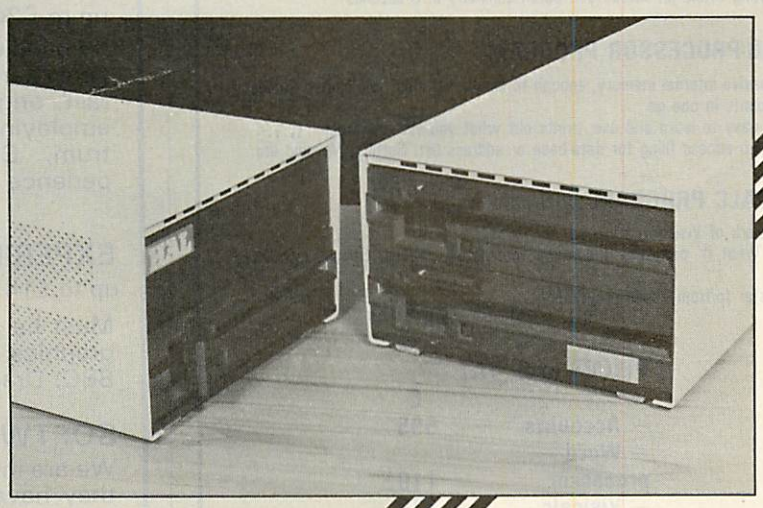

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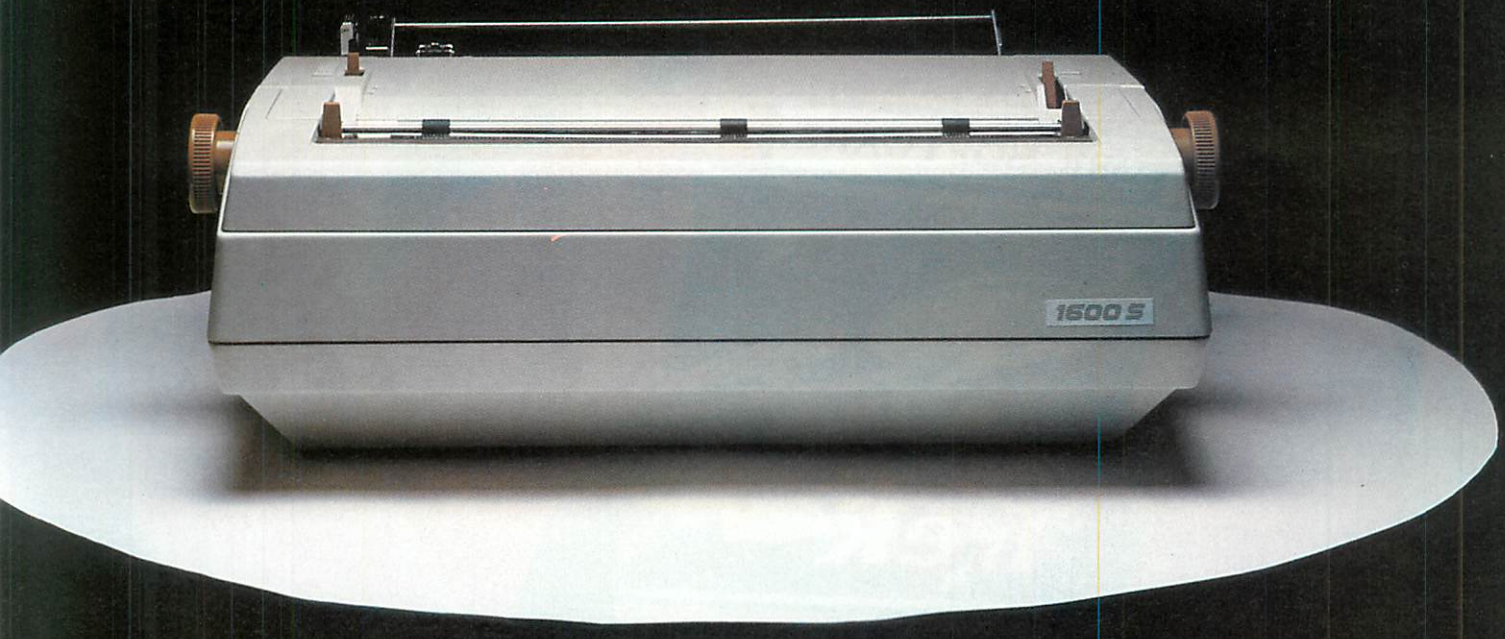

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"Oric was over twice as fast as the Spectrum. Surprisingly perhaps the Oric, which initially seemed only faster when performing the simplest of calculations, has come back to beat the Spectrum by a small amount. As the problems get more complex the Oric comes into its own. One final point – in entering the benchmark tests – the Oric was certainly the easiest to handle."

WHICH MICRO?

"This slope coupled with the design of the keys makes the Oric an easy machine to touch-type on. All keys have auto-repeat and there are four keys dedicated specifically to cursor control. It is certainly easier to type on than any of Sinclair's offerings."

YOUR COMPUTER

"Oric will soon be selling a Modem so that Prestel will become available. Owners will be able to accept telesoftware – programs loaded straight down the phone line – eventually electronic mail could come into the home by the same route, and with the addition of a tape recorder the Oric with its Modem could become a telephone answerer and message taker."

YOUR COMPUTER

"One good feature of the Oric is an on-screen reminder in the top right hand corner to show that you've engaged all-capitals mode. So much better than the BB's variety of lights in the corner of the keyboard. The Oric is sound, simple to get along with and offers great expansion potential."

WHICH MICRO?

"When compared to the stogginess of the Spectrum's keyboard this is certainly an improvement. I can't see any Orics failing through bad assembly. If only the £2400 IBM were so easy to use."

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Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

BBC Bytes: Caves of Traal; Find utility to search for keywords; Self-referencing sort; Submarine game — introduced by John Harris **161**

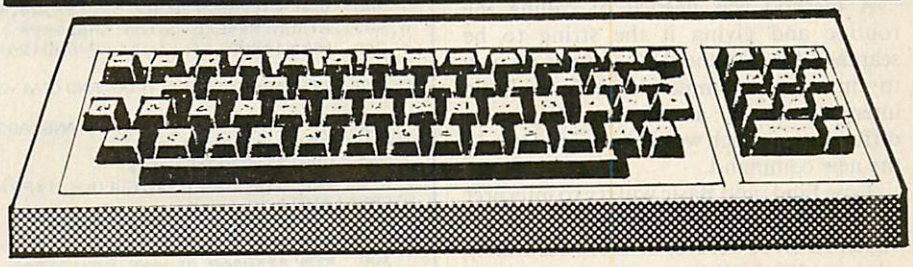
Tandy Forum: Perpetual calendar; Logical functions; Mastermind in Forth — introduced by John Wellsman **170**

Apple Pie: Clock face in motion on the screen; Generating music; Assembler representation; Connect Four game; avoid deleting files; Round the Bend game — introduced by John Harris **174**

Sinclair Line-up: Fitting data to a curve using polynomial regression on a ZX-81 **181**

Newbrain Nerve Centre: Letter writer for formatted text; Machine-code monitor; Hangman game — introduced by David Watt **185**

End of File: Pinball on Sharp MZ-80K; Chinese characters from Epson HX-20 portable **189**



Guidelines for contributors

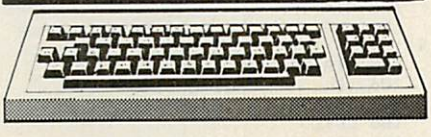
Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

PLEASE send a cassette or disc version of your program if at all possible. It will be returned after use. For CP/M programs use IBM-format 8in. floppy discs.

BBC BYTES

by John Harris



Caveman

VERY OCCASIONALLY I receive an entirely different game which works. By "entirely different" I mean that it is not a shooting game, a guessing game, or a speed-of-response game — that level of difference. James Downer of Harpenden has submitted what can only be described as a formalised nightmare.

Entitled Caves of Traal, the program sets up an enclosed arena with rather sinister cyan walls. Very little is required of the player in order to imagine the dripping water and the echoing slimy dankness, cyan has that sort of effect. Two characters are placed in the arena, representing the player and the caveman.

On pressing the space bar, a timer starts and the caveman begins edging toward you. Pressing the cursor-control keys moves the player character within the arena, allowing time to escape the clutches of the assailant. The edging soon becomes a series of short shuffles, breaking into more and more sustained running. There is no escape from eventually being mauled to death — a grisly crunch from the speaker accompanies the event. One can only hope to delay the inevitable, which is recorded on the timer display.

Caveman.

```
   5  ON ERROR GOTO 9000
  10  REM ***CAVEMAN***
  20  DATA 14,28,36,48,32,48,44,31,
21,12,25,10,4
  30  MODE 7
  40  PRINTCHR$(141);CHR$(134);"The
 Caves of Traal":PRINTCHR$(141);CHR$
(134);"The Caves of Traal"''''
  45  PRINT"You are trapped in a ca
ve with the      dreaded caveman. I
will draw the cave.  Then press any
key to start and RUN,    guiding you
rself with cursor keys"
  50  PRINT"Press SPACE BAR to cont
inue":REPEAT:C=GET:UNTIL C=32
  60  MODE 1:MOVE0,0:MOVE0,0
  65  *FX11,1
  66 *FX12,1
```

(continued on next page)

A Find utility

What must be the cleverest piece of code yet sent to this column has been submitted by Douglas Stewart of Edinburgh. The technique is of use in its own right to allow home coders to substitute functions as required. The utility as it stands has been invaluable ever since it arrived. It allows an investigation of program structures with greater facility than just scanning the listing, which previously had to suffice.

The technique adds a command to Basic, in this case Find. It allows all occurrences of any specified coding within the program in memory to be listed.

Sometimes it is useful to be able to find variables, keywords, etc. within a Basic program — especially if it is large or intricate. Several one-liners or function-key routines have been published to perform this function but have had two major disadvantages. They are slow and keywords are not tokenised. For example, Goto would not be found: the routine would look for the sequence G,O,T,O rather than the single token &E5.

A method was needed of calling the routine and giving it the string to be searched for. On the BBC there is no way to intercept commands before Basic interprets them, as on the Pet, so a different approach would be needed to add the new command.

Type Find, and Basic will try to interpret it, and of course will produce an error. When an error occurs, or more accurately when a 6502 BRK instruction is executed, the OS indirects through &202 — see page 452 in the *User Guide*. If you change the vector when an error occurs you can force the machine to jump to a user-supplied routine, where you can check what caused the error. If the word Find caused it you

(continued on page 164)

(continued from previous page)

```
   70  VDU 19,2,5,0,0,0:VDU 19,3,6,0
,0,0
   75  REM***Gives me palette of bla
ck,red,magenta,cyan***
   80  GCOL 0,3
   85  REM ***Draw walls in cyan***
   87  RESTORE20
   90  FOR B%=1 TO 13:READ Width:PLO
T 85,100*B%,Width:PLOT 85,100*B%,0:N
EXT B%
   95  REM x-wall
  100  RESTORE:MOVE 1280,0
  110  FOR B%=1 TO 11:READ Width:PLO
T 85,1280-Width,100*B%:PLOT 85,1280,
100*B%:NEXT B%
  115  REM y-wall
  120  RESTORE:MOVE 1280,1024
  125  REM y-wall
  130  FOR B%=1 TO 13:READ Width:PLO
T 85,1280-B%*100,1024-Width:PLOT 85,
1280-B%*100,1024:NEXT
  135  REM TOP x-wall
  140  RESTORE:MOVE 0,1024
  150  FOR B%=1 TO 11:READ Width:PLO
T 85,Width,1024-100*B%:PLOT 85,0,102
4-100*B%:NEXT
  155  REM LEFT y-wall
  160  REM***Cave walls finished***
  170  REM***Define User-Definable S
hapes***
  180  VDU 23,230,28,28,8,127,8,20,3
4,65:REM ***Player shape***
  190  VDU 23,224,0,56,254,186,170,4
0,68,68:REM ***Caveman shape***
  200  VDU 23,255,128,82,52,127,24,4
0,68,128:REM ***Explosion shape***
  210  HULK1=RND(33)+3:HULK2=RND(26)
+3
  220  XFUG=RND(33)+3:YFUG=RND(26)+3

  250  IF ABS(HULK1-XFUG)<=3 AND ABS
(HULK2-YFUG)<=3 THEN 220
  260  VDU 23;8202;0;0;0;
  270  VDU 31,XFUG,YFUG:COLOUR 1:PRI
NTCHR$(230);
  280  VDU 31,HULK1,HULK2:COLOUR 2:P
RINTCHR$(224);
  300  REM ***Game proper begins***
  305  *FX15,0
  310  C=GET
  320  TIME=0
  330  REPEAT
  340    *FX4,1
  350    *FX15,1
  360    J=INKEY(4):IF J>135 AND J<1
40 THEN PROCmovefug
  370    IF RND(1)<TIME/10000 THEN P
ROChulkmove
  380    COLOUR1:PRINTTAB(25,0);TIME
/100
  390    UNTIL FALSE
  400  REM ***Now procedures defined
***
 1000  DEFPROCmovefug
 1010  VDU 31,XFUG,YFUG:PRINT" ";
 1020  IF J=136 THEN XFUG=XFUG-1 ELS
E IF J=137 XFUG=XFUG+1 ELSE IF J=138
 YFUG=YFUG+1 ELSE YFUG=YFUG-1
 1025  IF XFUG<=2 THEN XFUG=XFUG+1 E
LSE IF XFUG>=37 XFUG=XFUG-1 ELSE IF
YFUG<=2 THEN YFUG=YFUG+1 ELSE IF YFU
G>=30 THEN YFUG=YFUG-1
 1030  COLOUR 1
 1040  VDU 31,XFUG,YFUG:PRINTCHR$(23
0);
 1050  IF XFUG=HULK1 AND YFUG=HULK2
THEN T=TIME:PROCexpl
 1060  ENDPROC
 1100  DEFPROChulkmove
 1110  VDU 31,HULK1,HULK2:PRINT" ";
 1120  IF HULK1>XFUG THEN HULK1=HULK
1-1
 1130 IF HULK1<XFUG THEN HULK1=HULK1
+1
 1140 IF HULK2>YFUG THEN HULK2=HULK2
-1
 1150  IF HULK2<YFUG THEN HULK2=HULK
2+1
 1160  COLOUR 2:VDU 31,HULK1,HULK2:P
RINTCHR$(224);
 1165  IF HULK1=XFUG AND HULK2=YFUG
THEN T=TIME:PROCexpl
 1170  ENDPROC
 1200  DEFPROCexpl
 1210  VDU 19,2,12,0,0,0
 1215  COLOUR 2
 1220  VDU 31,XFUG,YFUG
 1230  PRINTCHR$(255);
 1240  ENVELOPE 1,8,1,-1,1,1,1,1,121
,-10,-5,-2,120,120
 1250  SOUND &0010,1,100,255
 1260  FOR D%=1 TO 2000:NEXT
 1270  CLS
 1280  PRINT"You lasted for ";T/100;
" seconds. Do you want another game
(Y/N)";
 1290  C$=GET$:IF C$<>"Y" AND C$<>"N
" THEN 1290
 1295  SOUND 0,0,0,1
 1297  IF C$="N" THEN 9000
 1300  IF C$="Y" THEN CLEAR:GOTO60

 1310  ENDPROC
 9000  CLS:*FX12,0
 9005  COLOUR 1:PRINT"Type RUN to re
-run the program"
 9010  END
```

Find utility.

```
  100 REM THIS PROGRAM ADDS THE COMM
AND
  101 REM 'FIND' TO THE BEEB'S BASIC
.
  102 REM BY DOUGLAS STEWART
  103 REM VERSION 2.1 FEB'83
  104 REM SYNTAX:FIND [string]
  105 REM (KEYWORDS ARE TOKENISED)
  106 BASIC=&8A99:REM BASIC RE-ENTRY
  107 BASE%=&D00:REM ASSEMBLY ADDRES
S
  108 Z=&70:REM BLOCK IN ZERO PAGE T
O USE                 (Z TO Z+6 ARE US
ED)
  109 DITFLAG=Z+6
  110 TP=Z+2:REM TEXT POINTER
  111 LS=Z+4:REM LENGTH OF STRING
  112 LB=Z+5:REM LENGTH OF BASIC LIN
E
  113 FORP=1TO3STEP2
  114 P%=BASE%
  115 [
  116 OPT P
  117
  118 LDY£0
  119 STY Z
  120 LDA£7
  121 STA Z+1
  122 JSR CHECK    \IS IT THE COMMAND
?
  123 BEQ YES
  124 JMP &B433    \ERROR ROUTINE
  125 .YES
  126 STA&700
  127 JSR FIND     \PERFORM FUNCTION
  128 .OT
  129 JMP BASIC
  130
  131
  132 \ ROUTINE TO CHECK IF NEW COMM
AND
  133 \ IS BEING USED
  134
  135 .CHECK
  136 JSR MOV+1    \FIND NON-SPACE CH
AR
  137 STY Z
  138 LDY£3
  139
  140 .L2
  141 LDA WORD,Y   \COMMAND WORD
  142 CMP(Z),Y     \COMPARE EACH CHAR
  143 BNE OUT
  144 DEY
  145 BPL L2
  146
  147 LDY£3
  148 LDA£0
  149 .OUT
  150 RTS
  151 ]
  152 PROCFIND
  153 NEXTP
  154 $WORD="FIND"
  155 REM ALTER BRK VECTOR
  156 ?&202=BASE%MOD256
  157 ?&203=BASE%DIV256
  158 END
  159 DEFPROCFIND
  160 [
  161 OPT P
  162
  163 \ROUTINE TO SEARCH FOR THE STR
ING
  164
  165 .FIND
  166 JSR MOV       \MOVE TO START OF
THE
  167 CLC          \STRING BEING SEAR
CHED
  168 TYA          \FOR
  169 ADC Z
  170 STA Z
  171 LDY£0
  172 .L5
  173 LDA(Z),Y
  174 INY
  175 CMP£13
  176 BNE L5
  177 DEY
  178 STY LS
  179 BEQ OT
  180
  181 \STRING POINTED TO BY (Z),Y
  182 LDA£1
  183 STA TP
  184 LDA&18       \GET VALUE OF 'PAG
E'
  185 STA TP+1
  186 .BL
  187 JSR&9834     \TEST ESCAPE KEY
  188 LDY£0
  189 LDA(TP),Y    \LINE NUM HIGH BYT
E
  190 STA&2B       \INTO IAC
```

(listing continued on page 164)

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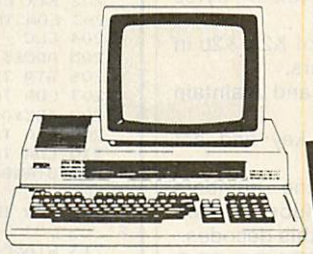

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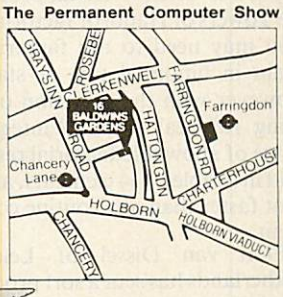

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(continued from page 162)

can ignore the error and perform the new function, otherwise you can give control back to Basic. Since Basic has already tried to interpret the line typed in, keywords have already been tokenised.

From here on the utility simply isolates the string to be searched for and attempts to match it against the text. If it finds a match the line is listed. It was not possible to use Basic's own routine for listing lines. But various ROM routines are available to simplify matters as follows:

&B53A — Print the character in the accumulator expanding token bytes when found.

&98F5 — Print the contents of &2A &2b in decimal, for the line numbers.

&B571 — Print a character and maintain Count.

&9834 — Test the escape key and act accordingly

&97B6 — On the BBC line numbers associated with Gotos, Gosubs, etc., are encoded in an odd way — this decodes.

The program works with OS 1.0 and 1.2, though after pressing Break on 1.2 the program will probably need rerunning. It will probably not work with Issue II Basic but since nobody has it yet, this is not too important.

The net effect is the ability to type Find Proc and see at a glance all the procedure calls and defines. Type Find 131 to catch all the references to mode 7 yellow alphanumeric. Within the version printed the return is always made to Basic, so all OS, Utils, or DOS commands are disabled after setting up Find until the next Break. Consequently Find cannot be left installed at all times.

In addition to the Find command there is a set of base change functions. They are the second most useful application of recursion I have received, and are an admirable example of elegance and brevity of both design and execution.

Sort

Self-referencing procedures of functions are powerful as they implicitly provide an indefinite set of local intermediate storage variables. You get a lot of routine for a little code at the expense of thinking instead of just doing. The trouble is that they are applied so often to trivial problems such as the Towers of Hanoi or factorial evaluation. You may need to use factorials now and again in binomial this or statistical that. However with the precision of BBC Basic being 10^{38} real and 10^{10} integer the entire range of allowable factorial results could be held in a table of 34 elements, and looked up a lot faster than any routine could generate them.

Flon van Dissel of Leiden in the Netherlands has sent a sort procedure which is brief and self-referencing in a non-trivial way. It produces very respectable sort times, which I reproduce from an example run of the skeleton code the procedure was tested with. Obviously being in Basic it is not in the

(continued on page 169)

(listing continued from page 162)

```
  191 BPL BP4      \NEGATIVE WOULD ME
AN
  192 RTS          \END OF PROGRAM
  193 .BP4
  194 INY
  195 LDA(TP),Y    \LINE NUM LOW BYTE
  196 STA&2A       \INTO IAC
  197 INY
  198 LDA(TP),Y
  199 SEC          \
  200 SBC£4        \GET LENGTH OF ACT
UAL
  201 TAX          \TEXT OF LINE
  202 STX LB
  203 LDA TP
  204 CLC
  205 ADC£3
  206 STA TP
  207 LDA TP+1
  208 ADC£0
  209 STA TP+1
  210 LDA TP
  211 STA&B        \SET UP POINTER IN
TO
  212 LDA TP+1     \TEXT OF BASIC LIN
E
  213 STA&C
  214 .CL
  215 LDY£0
  216 .DL
  217 LDA(Z),Y
  218 CMP(TP),Y
  219 BNE BP5      \STRING DOESN'T MA
TCH
  220 INY
  221 CPY LS       \COMPARED ALL OF I
T?
  222 BNE DL
  223
  224              \STRING IS FOUND
  225 JSR PL       \PRINT OUT LINE
  226 JSR&FFE7     \LINEFEED (OSNEWL)
  227 LDX LB
  228 INX
  229 TXA          \ADJUST TEXT POINT
ER
  230 CLC          \TO POINT TO START
  231 ADC&B        \OF NEXT LINE OF
  232 STA TP       \BASIC
  233 LDA&C
  234 ADC£0
  235 STA TP+1
  236 JMP BL       \GO ONTO NEXT LINE
  237
  238 .BP5
  239 INC TP
  240 BNE BP6
  241 INC TP+1
  242 .BP6
  243 DEX
  244 BNE CL       \COMPARE NEXT SECT
ION
  245 INC TP
  246 BNE BP8
  247 INC TP+1
  248 .BP8         \FINISHED SO GO ON
  249 JMP BL       \TO NEXT LINE
  250
  251 .PL
  252 JSR&98F5     \PRINT LINE NUMBER
  253 LDY£0
  254 STY DITFLAG
  255 .L8
  256 LDA(&B),Y    \GET CHAR
  257 CMP£34       \IS IT A QUOTE MAR
K?
  258 BNE B
  259 EOR DITFLAG \IF SO,THEN FLIP
  260 STA DITFLAG \THE QUOTE FLAG
  261 LDA£34
  262 .B
  263 PHA          \PUT CHAR ON STACK
  264 LDA DITFLAG
  265 BNE BP10
  266 PLA
  267 JSR&97B6     \UNSCRAMB IF LINE
NUM.
  268 BCC BP11     \IE. IF NOT LINE N
UM.
  269 TYA
  270 PHA
  271 JSR&98F1     \PRINT OUT LINE
  272 PLA          \NUM. (AS IN GOTO/
  273 TAY          \ GOSUB)
  274 BNE BP12
  275 .BP11
  276 JSR&B53A
  277 .BP13
  278 INY
  279 .BP12
  280 CPY LB       \END OF LINE?
  281 BNE L8       \NO,SO CONTINUE.
  282 RTS
  283
  284 .BP10
  285 PLA
  286 JSR&B571
  287 .BEP
  288 JMP BP13
  289
  290 \ROUTINE TO MOVE POINTER TO NE
XT
  291 \NON-SPACE CHARACTER
  292 .MOV
  293 INY
  294 LDA(Z),Y
  295 CMP£32
  296 BEQ MOV
  297 RTS
  298 .WORD
  299 ]
  300 ENDPROC
```

Sort example timings.

```
 100 took     5.69 seconds, the last 100 added     5.69
 200 took    11.18 seconds, the last 100 added     5.49
 300 took    17.88 seconds, the last 100 added     6.70
 400 took    24.95 seconds, the last 100 added     7.07
 500 took    32.07 seconds, the last 100 added     7.12
 600 took    40.76 seconds, the last 100 added     8.69
 700 took    48.30 seconds, the last 100 added     7.54
 800 took    56.34 seconds, the last 100 added     8.04
 900 took    62.69 seconds, the last 100 added     6.35
1000 took    69.66 seconds, the last 100 added     6.97
1100 took    77.24 seconds, the last 100 added     7.58
1200 took    88.84 seconds, the last 100 added    11.60
1300 took    96.98 seconds, the last 100 added     8.14
1400 took   102.15 seconds, the last 100 added     5.17
1500 took   110.54 seconds, the last 100 added     8.39
1600 took   121.78 seconds, the last 100 added    11.24
1700 took   127.77 seconds, the last 100 added     5.99
1800 took   140.39 seconds, the last 100 added    12.62
1900 took   150.96 seconds, the last 100 added    10.57
2000 took   153.46 seconds, the last 100 added     2.50
```

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BM. 4.	9.8	12.6	17.5
BM. 5.	10.5	13.6	19.8
BM. 6.	18.7	23.5	35.4
BM. 7.	29.6	37.4	55.9
BM. 8.	5.1	3.5	4.3

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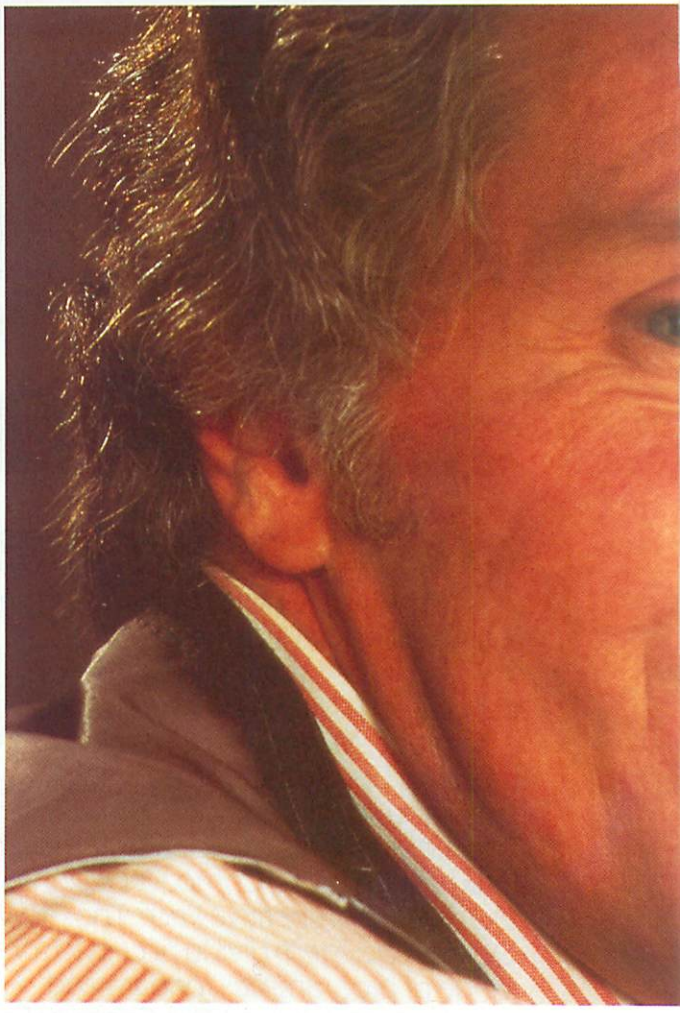

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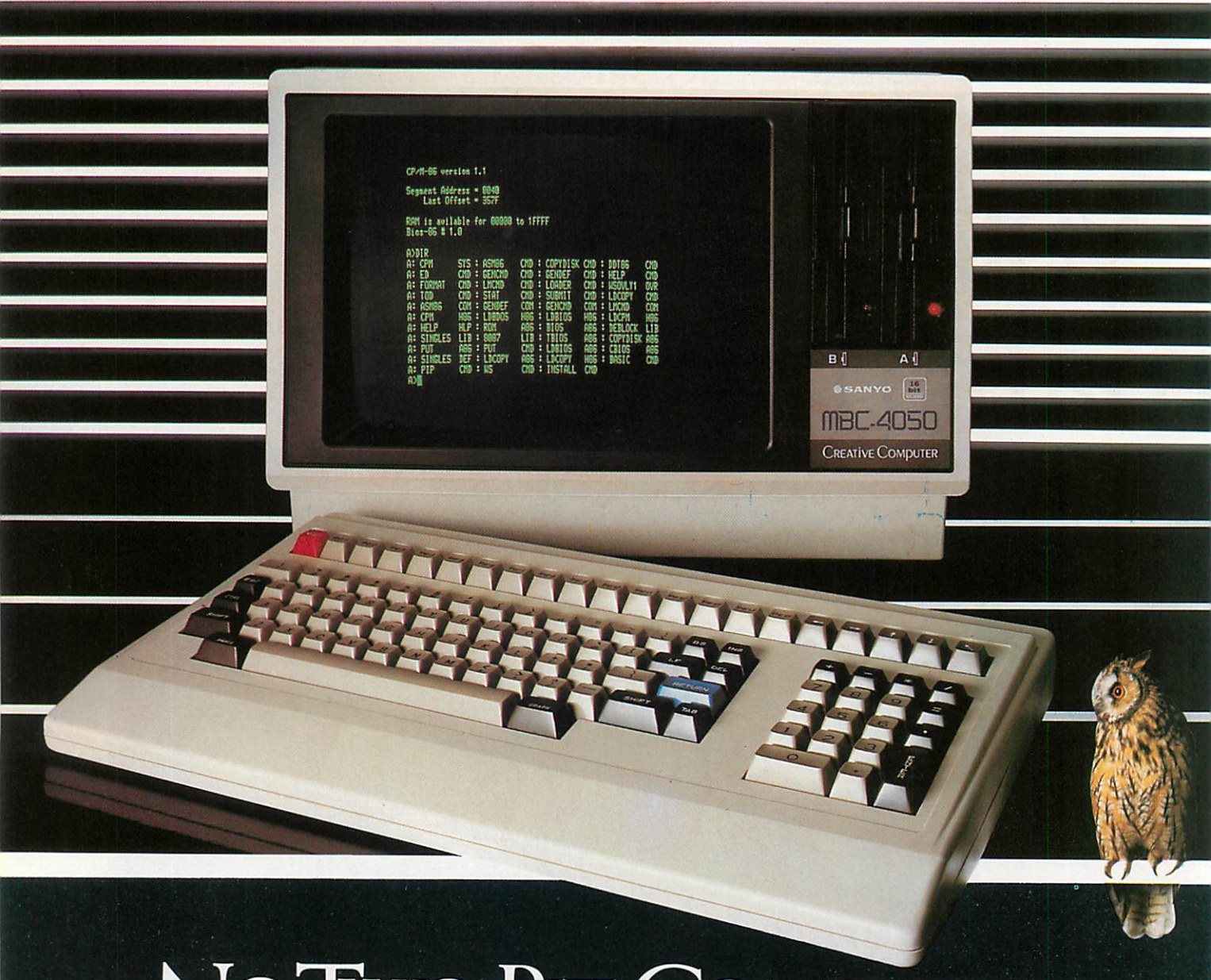

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(continued from page 164)

same league as a well-coded assembler sort, but the timings are a vast imnprovement on some and the code is a lot more understandable.

It is an adaptation of the famous Quicksort algorithm of C A R Hoare. The procedure Sort (L,H) expects an integer-array A% to be declared and ready to be sorted. For reals or strings just change all A%s, Y% and the H% in Procexch. The parameters L and H specify the low and high array elements to be included in the sort.

Sort is based on the idea that exchanges should preferably be made over large distances to be most effective. Pick a RND item Y% though selecting the median of the array section would give the best result, and scan from the left until an item A%(I%)>Y% is found, then scan from the right until A%(I%)<Y%. Exchange these two items and continue the scan and exchange process until the two scans meet somewhere in the middle of the array section.

Following the so-called partition of (A%(M%),A%(N%)), the Local I% and J% have been found with the following properties:

If A%(T%)< = Y% then M%< = J%< I%< = N%
A%(T%)< = Y% for M%< = T%< = J%
A%(T%) = Y% for J%<T% <I%
A%(T%)>Y% for I%< = T%< = N%

Now simply apply the same partition process to the two partitions generated (M% to J% and I% to N%) by a recursive call to Procsort for each, until the partition consists of less than three elements.

Some improvements are optional.

- Take for Y% the median of three or five randomly selected elements in A%, though this will also involve a change in line 110.
- Quicksort becomes "slowsort" for very small array sections, so try jumping to another sort routine when a partition has a size less than x, between five and 15.
- Reduce the stack-for-recursion size by calling directly the largest subfile and stacking the smaller, in line 120.

Submarine

A game rather more violent in the intention than the act has been submitted by Martin Holmes of Uxbridge for the Model B running in Mode 1. A submarine is controlled at a fixed height above the sea bed and has an inexhaustible supply of torpedoes. Ships make regular depth charge runs at various heights above the submarine, doubtless operating in tidal waters. With the restriction of having one torpedo running at a time, the exercise is a kind of turkey shoot until carelessness intervenes.

The display is very pretty and the missiles and explosions make the appropriate noises. Controls are B left, M right and N to fire. For those who cannot keep up with the aggressive program that accelerates from an initially overfast beginning, the implementation provides a pleasing backwater.

Sort.

```
   10 VDU2:DIMA%(2000):TL=0
   20 FORENTS=100TO2000STEP100
   30   FORI=1TOENTS:A%(I)=RND(10000
):NEXT I
   40   T=TIME:PROCSORT(1,ENTS):TT=(
TIME-T)/100:T1=TT-TL:TL=TT:@%=&00004
:PRINT,ENTS;:@%=&20206:PRINT" took "
,TT;" seconds, the last 100 added",T
1
   50   NEXTENTS:VDU3:END
   60 DEFPROCSORT(M%,N%)
   70 LOCAL I%,J%
   80 IF M%>N%-1 THEN 130 ELSE IF N%
-M%=1 AND A%(N%)<A%(M%) PROCEXCH(M%,
N%):GOTO 130 ELSE X%=FNRN(M%,N%):Y%=
A%(X%):I%=M%:J%=N%
   90 I%=I%-1:REPEAT I%=I%+1:UNTIL I
%=N% OR Y%<A%(I%):IF Y%>=A%(I%) I%=N
%
  100 J%=J%+1:REPEAT J%=J%-1:UNTIL J
%=M% OR A%(J%)<Y%:IF A%(J%)>=Y% J%=M
%
  110 IF I%<J% PROCEXCH(I%,J%):I%=I%
+1:J%=J%-1:GOTO90 ELSE IF I%<X% PROC
EXCH(I%,X%):I%=I%+1 ELSE IF X%<J% PR
OCEXCH(X%,J%):J%=J%-1
  120 PROCSORT(M%,J%):PROCSORT(I%,N%
)
  130 ENDPROC
  140 DEFFNRN(E%,F%)=RND(F%-E%)+E%-1
  150 DEFPROCEXCH(E%,F%)
  160 LOCAL H%
  170 H%=A%(E%):A%(E%)=A%(F%):A%(F%)
=H%
  180 ENDPROC
```

Submarine.

```
   10REM       *** SUB ***
   20REM
   30REM    * A PROGRAM WRITTEN BY *
   40REM        * M HOLMES *
   50REM
   60REM £ USE B,N AND M FOR CONTROL
S £
   70REM
   80MODE1
   90PROCchars
  100PROCinit
  110ONERROR PROCsubhit:RUN
  120REPEAT
  130PROCplay
  140UNTIL finish
  150*FX15,1
  160INPUTTAB(10,20)"Another game",g
ame$
  170IF LEFT$(game$,1)="Y" OR game$=
"" THEN RUN
  180MODE7
  190END
  200DEFPROCplay
  210IF INKEY(-101) AND subx>0THEN C
OLOUR 0:PRINTTAB(subx,27)sub$:COLOUR
1:subx=subx-1:PRINTTAB(subx,27)sub$
  220IF INKEY(-102) AND subx<35THEN
COLOUR 0:PRINTTAB(subx,27)sub$:COLOU
R 1:subx=subx+1:PRINTTAB(subx,27)sub
$
  230IF INKEY(-86) AND NOT fire THEN
 fire=TRUE:missilex=subx+1:missile=m
issile+1:SOUND 1,-15,100,2
  240IF fire THEN IF POINT(missilex*
32+15,1023-missiley*32)=1 THEN PROCh
it
  250IF fire THEN COLOUR 0:PRINTTAB(
missilex,missiley);CHR$(226):missile
y=missiley-1:COLOUR 2:PRINTTAB(missi
lex,missiley);CHR$(226):SOUND 0,-8,4
,1:IF missiley=0 THEN fire=FALSE:mis
siley=25:COLOUR 0:PRINTTAB(missilex,
0);CHR$(226)
  260IF NOT dcharge AND subx+6>boatx
 AND subx-4<boatx AND RND(4)=1 THEN
dcharge=TRUE:DY=boaty:DX=boatx:SOUND
 2,-15,1,2
  270IF dcharge THEN COLOUR 0:PRINTT
AB(DX,DY);CHR$(228):DY=DY+1:COLOUR 2
:PRINTTAB(DX,DY);CHR$(228):SOUND 2,-
10,150,1:IF DY=28 THEN COLOUR 0:PRIN
TTAB(DX,28);CHR$(228):SOUND 0,-15,5,
2:dcharge=FALSE
  280COLOUR 0:PRINTTAB(boatx,boaty);
boat$;TAB(boatx+1,boaty-1)btop$:boat
x=boatx-1
  290COLOUR 1:PRINTTAB(boatx,boaty);
boat$:COLOUR 2:PRINTTAB(boatx+1,boat
y-1)btop$
  300IF boatx=0 THEN boatx=36:COLOUR
 0:PRINTTAB(0,boaty);boat$;TAB(1,boa
ty-1);btop$:BY=RND(18)+2
  310IF dcharge THEN IF POINT(DX*32+
16,1023-DY*32-40)=1 THEN PROCsubhit:
finish=TRUE
  320ENDPROC
  330DEFPROChit
  340fire=FALSE:COLOUR 0:PRINTTAB(mi
ssilex,missiley);CHR$(226):missiley=
25
  350PRINTTAB(boatx+1,boaty-1)btop$
  360COLOUR 1:PRINTTAB(boatx,boaty);
debris$
  370FOR VOL=-15 TO -8 STEP 4
  380SOUND 0,VOL,4,3
  390NEXT
  400FOR VOL=-15 TO -10 STEP 2
  410SOUND 0,VOL,6,3
  420NEXT
  430FOR VOL=-15 TO -8
  440SOUND 0,VOL,5,3
  450NEXT
  460T!ME=0:REPEAT UNTIL TIME>100
  470COLOUR 0:PRINTTAB(boatx,boaty);
delete$
  480boatx=36:boaty=RND(18)+2
  490SCORE=SCORE+1
  500ENDPROC
  510DEFPROCsubhit
  520COLOUR 0
  530PRINTTAB(subx,27);sub$
  540PRINTTAB(DX,DY);CHR$(228)
  550COLOUR 1
  560PRINTTAB(subx,27);debris$
  570FOR VOL=-15 TO -5
  580SOUND 0,VOL,4,2
  590NEXT
  600FOR VOL=-15 TO 0
  610SOUND 0,VOL,6,5
  620NEXT
  630PRINTTAB(subx,27);delete$
  640TIME=0:REPEAT UNTIL TIME>200
  650CLS:VDU19,0,3,0,0,0
  660PRINTTAB(5,10)"Y O U  H A V E
B E E N  H I T !"
  670PRINTTAB(3,15)"You destroyed ";
SCORE;" ships and  used ";missile;"
   missiles."
  680ENDPROC
  690DEFPROCinit
  700subx=10
  710dcharge=FALSE
  720missile=0:missiley=25
  730SCORE=0
  740VDU23;11,1;0;0;0
  750VDU19,0,6,0,0,0,19,3,2,0,0,0
  760COLOUR 3
  770DRAW0,95:PLOT85,1279,0
  780PLOT85,1279,95
  790COLOUR 1
  800PRINTTAB(subx,27)sub$
  810fire=FALSE
  820boatx=36:boaty=15
  830finish=FALSE
  840ENDPROC
  850DEFPROCchars
  860VDU23,224,255,255,255,255,255,2
55,255,255
  870VDU23,225,31,31,31,31,31,31,31,
31
  880VDU23,226,4,14,31,31,31,31,31,3
1
  890VDU23,227,255,127,63,31,15,7,3,
1
  900VDU23,228,24,60,126,255,255,126
,60,24
  910VDU23,229,255,255,195,195,195,2
55,255,255
  920VDU23,230,248,253,255,253,253,2
55,253,248
  930VDU23,231,63,127,127,255,255,12
7,127,63
  940sub$=CHR$(231)+CHR$(11)+CHR$(22
5)+CHR$(10)+CHR$(8)+CHR$(224)+CHR$(2
24)+CHR$(224)+CHR$(230)
  950boat$=CHR$(227)+CHR$(224)+CHR$(
224)+CHR$(224)+CHR$(224)
  960debris$=" _*-_*|-£"
  970delete$="          "
  980btop$=CHR$(229)+CHR$(11)+CHR$(2
29)+CHR$(10)+CHR$(8)+CHR$(229)+CHR$(
224)
  990ENDPROC
```

TANDY FORUM

by John Wellsman

Perpetual calendar

A PERPETUAL calendar comes from Mr A Wit who lives in Hoorn, The Netherlands. Mr Wit suggests it is nearly the shortest possible and that it will give the day of any date back to 1582.

It will, but only on the Continent. In that year, Pope Gregory revised the old Julian calendar, instituted by Julius Caesar, which by the 16th century had got rather out of step with real time. Protestant England under Elizabeth I refused to have anything to do with such Papish innovations and it was not until 1752, when we were 11 days out of step with the Continent, that we adopted the Gregorian claendar.

Logical functions

Any programmer, no matter what language he or she uses, should have a thorough grasp of both binary arithmetic and logic as their use can increase the speed and shorten the program, especially Basic.

The essential thing is to fully understand the functions And, Or and Not. We frequently use the first two in instructions like

IF A = 1 AND B = 2 THEN. . . . .

but this is only a very limited use of the function. The full and proper use of the logical operators And and Or is to compare the corresponding bits of two integer values and produce a third value from the result.

The address in line 30 of Steve Holloway's program is one of those receiving keyboard input data, and lines 40 to 95 decide by direct logical comparison of each individual bit what has been input into address 14400. You can see for yourself if you use this little routine:

```
10 A = PEEK(14400):PRINT@470, A:GOTO
   10
```

By pressing the arrows, etc. you will see the values that they give to the address.

According to the value at 14400 the program modifies the position of the cursor by altering the set values of X and Y, giving the impression of movement.

Steve Holloway also uses the logical function Not. It is not quite so simple to explain but the effect is to multiply the operand by −1 and subtracting 1, so

NOTX = (X * −1) − 1

It is well worth becoming familiar with computer logic. There are several books dealing with the subject, and Lewis Rosenfelder's *Basic Better and Faster and Other Mysteries* gives some excellent examples of how to put logical functions to good use.

Tandy Forth

There is no doubt that the Forth language has increased in popularity thanks to the availability of the language for many micros, and not least because someone has been brave enough to produce a micro dedicated to it. The Tandy Model I has long had a Forth compiler available to it, though only a few enthusiasts ever progressed far with it.

There is no concealing the fact that compared with Basic, Forth is not an easy language to learn, especially if you have begun with Basic. But the rewards for learning its discipline are great. It is very fast and efficient, and it provides a knowledge of programming that can never be acquired if you only use Basic alone. Mr Ernest Bebbington has provided a very useful account of Forth which I hope, will stimulate others to experiment.

(continued on page 172)

Perpetual calendar.

```
10 CLS:DIMK(12)
20 PRINT" ** PERPETUAL CALENDAR
**":PRINT
30 DEFINT D,M,Y:INPUT "ENTER DATE
(DAY, MONTH, YEAR)";D,M,Y
40 FOR I=1 TO 12:READ K(I):NEXT:IF
Y/4=INT(Y/4)THEN K(2)=29
50 IF D>0  AND D<=K(M) AND M>0 AND
M<=12 AND Y>1582 THEN 70
60 PRINTTAB(15)"* ERROR *":RESTORE:
GOTO 30
70 YR=Y:FOR I = 1 TO 12:READ N$:IF I=M
THEN M$=N$
80 NEXT: IF D=1 OR D=21 OR D= 31 THEN
D$="ST" ELSE IF D=2 OR D=22 THEN
D$="ND"
90 IF D=3 OR D=23 THEN D$="RD"
100 A=365*Y+D+31 * (M-1): IF M<=2 THEN
Y=Y-1 ELSE A=A-INT(.4*M+2.3)
110
A=A+INT(Y/4)-INT(.75*(INT(Y/100)+1))
120 A=INT((A/7-INT(A/7))*7+.5):FOR I=0
TO A:READ A$:NEXT
130 PRINT"- ";A$;"DAY ";D;D$;" ";M$;"
";YR;" -"
140 PRINT:RESTORE:GOTO 30
150
DATA31,28,31,30,31,30,31,31,30,31,30,31

160
DATAJANUARY,FEBRUARY,MARCH,APRIL,MAY,JU
NE,JULY,AUG,SEPT,OCT,NOV,DEC
170
DATASATUR,SUN,MON,TUES,WEDNES,THURS,FRI
```

Logical functions.

```
10 DEFINTA-Z
20
CLS:X=64:Y=24:SET(X,Y):Y1=Y:X1=X:REM
sets cursor in the middle of the
screen.
30 A=  PEEK(14400):B=NOTB:IF A=0  THEN
IF B THEN RESET (X,Y)
40 IF A  AND 32 THEN X1=X-1 :REM  left
arrow
50 IF A AND 64  THEN X1=X+1 :REM right
arrow
60  IF  A  AND  8 THEN Y1=Y-1  :REM up
arrow
70 IF  A AND 16 THEN  Y1=Y+1 :REM down
arrow
80  IF  A  AND  128  THEN FOR  I=1  TO
50:NEXT :REM space bar
90  IF A AND  2 THEN  RESET  (X,Y):REM
Clear
95 IF  A AND  1  THEN  GOSUB 1000  REM
enter
100  X=X1 AND 127: IF  Y1>47  THEN Y=0
ELSE IF Y1<0 THEN Y = 47 ELSE Y=Y1
110 SET (X,Y): GOTO 30
1000 REM INVERT ROUTINE
1010 FOR I= 15360 TO 16383
1015  IF   PEEK(I)<  128   THEN   POKE
I,191:GOTO 1030
1020  POKE(I),  NOTPEEK(I) AND 191  OR
128
1030 NEXT I: RETURN
60023 SAVE"HOLOG/PC:1
```

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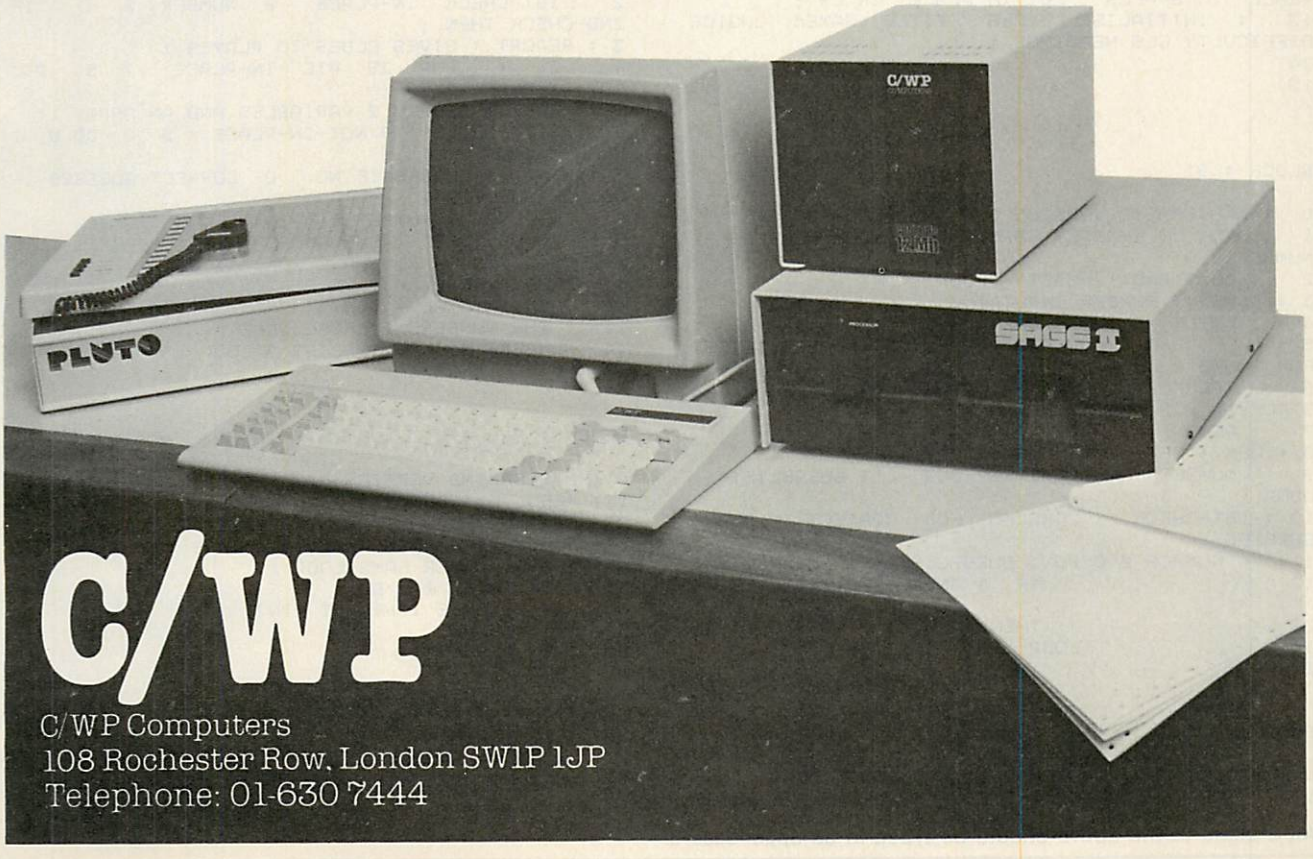

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● Circle No. 216

(continued from page 170)

The fundemental building block of Forth is the word, a user-defined function loosely analogous to the Def FN command in Basic. Like the Basic command, Forth words are usually defined in terms of previously defined words. Thus one word can call up the definitions of many other words through a complex chain of definitions. Any word defined by the programmer has equal status with all of the words already contained in the implementation.

To be accurate, you do not write programs in Forth, you merely configure the existing implementation to carry out the task required. For example, to write a word processor in Forth, definitions are added to the existing set of words to make the computer function as a word processor. A particular inducement to using Forth is its ability to operate up to 30 times faster than Basic.

The game Mastermind written for a computer is not exactly unique, but it does illustrate the structured approach necessary when writing in Forth. The idea is that the computer chooses a group of numbers and the player has to guess what they are. After each set of guesses the computer tells the player how many of the guesses are correct and if they were in the right order. After a certain number of guesses the computer tells the player the correct answers.

In this version, when making the guesses the Enter or Return key does not have to be pressed. Just type in the required number of figures. When setting the difficulty of the game — the number of figures to guess and number of guesses — you do have to press Enter.

PTC positions the cursor at a co-ordinate on the screen. The format is row, column PTC. # In operates like Input in Basic except that the number input is put on to the parameter stack and is not directly transferred to a variable. CLS clears the screen and homes the cursor. RND chooses a random integer between 1 and the number at the top of the stack.

While-Perform-Pend is an indefinite loop. The words between While and Perform are executed, and Perform tests the value left on the stack. If it is a logical True value, 1, then the words following Perform are executed and the loop is started again. If it is false, the loop is left and the words following Pend are executed.

Tandy Forth.

```
BLOCK : 90
0 ( MASTERMIND VERSION  0.2  1ST BLOCK OF  5)  :
TASK ;
1  0 VARIABLE  NUMBER   0 VARIABLE  IN-PLACE   0
VARIABLE WON
2 0  VARIABLE NOT-IN-PLACE  0 VARIABLE TOTAL   0
VARIACLE TRIES
3  5 ARRAY  NLIST  5  ARRAY  GUESSLIST   5 ARRAY
FLAG
4
5 : TITLE  0 20 PTC " MASTERMIND VERSION 0.2" ;
6  : GAME£  5 0  PTC " GAME NUMBER " TOTAL @ 1 +
. ;
7 :  CHOICE  7 0 PTC " HOW  MANY NUMBERS SHALL I
CHOOSE "
8 :    "FOR YOU TO GUESS  (3-6 " £IN 3 MAX 6 MIN
NUMBER ! ;
9 : DIFFICULTY  9 0 PTC "  HOW MANY  GUESSES  AT
THE NUMBERS DO "
10   " YOU  WANT ( 5 - 10 ) "  £IN 5 MAX 10  MIN
TRIES ! ;
11 :  HEADINGS CLS " YOUR GUESS" 15 SPACES "  IN
PLACE" 15 SPACES " NOT IN PLACE" CR CR ;
13   :  INITIALISE    CLS   TITLE  GAME£  CHOICE
DIFFICULTY CLS HEADINGS ;
14
15



BLOCK : 91

0  ( MASTERMIND VERSION 0.2 2ND BLOCK OF 5)
1  : PICK  ( CHOOSES  GROUP OF RANDOM NUMBERS  )
NUMBER @ 0
2     DO 9 RND I NLIST ! LOOP ;
3 : INKEY ( NUMBER INPUT )
4     WHILE KEY 48 - DUP
5           1  ( OVER 9 ) OR  (GET NUMBER & TEST
FOR RANGE )
6      PERFORM  DROP   ( NOT IN  RANGE  SO CLEAR
STACK & LOOP AGAIN )
7     PEND ;
8 : ASK ( GET PLAYERS GUESSES )
9     NUMBER @ 0  DO INKEY DUP  . I GUESSLIST  !
LOOP ;
10 : 1ST-CHECK  (  CHECKS  FOR  CORRECT IN-PLACE
GUESSES )
11     NUMBER @ 0 DO I GUESSLIST @ I NLIST @ =
12                  IF  1 IN-PLACE +!  1 I FLAG
!
13                  THEN
14               LOOP ;
15



BLOCK : 92

0 ( MASTERMIND VERSION 0.2  3RD BLOCK OF 5 )
1  :  2ND-CHECK ( CHECKS  FOR EQUAL NOT-IN-PLACE
NUMBERS )
2   NUMBER @ 0 DO I FLAG @ 1 <>
3   IF NUMBER @ 0
4   DO I J <>
5   IF I FLAG @ 1 <>
6   IF I FLAG @ -1 <>
7   IF J GUESSLIST @ I NLIST @ =
8   IF 1 NOT-IN-PLACE +!
9   -1 I FLAG ! LEAVE
10  THEN
11  THEN
12  THEN
13  THEN
14  LOOP
15  THEN LOOP ;


BLOCK :  93

0 ( MASTERMIND VERSION 0.2 4TH BLOCK OF 5 )
1 :  COMPARE  ( COMPARES  GUESSES  TO  ' HIDDEN
NUMBERS )
2    1ST-CHECK  IN-PLACE   @  NUMBER  @  <>   IF
2ND-CHECK THEN ;
3 : REPORT ( GIVES CLUES TO PLAYER )
4    2   +   DUP  29  PTC  IN-PLACE   ?  52  PTC
NOT-IN-PLACE ? CR ;
5 : RESET ( RESETS 2 VARIABLES AND AN ARRAY )
6    0 IN-PLACE ! 0 NOT-IN-PLACE ! 5  0  DO 0  I
FLAG ! LOOP ;
7 : WIN?  ( CHECKS IF NO.  OF CORRECT GUESSES  -
NO. OF NUMBERS )
8   IN-PLACE @ NUMBER @ = ;
9 : WIN-OR-LOSE? ( CHECKS FOR WIN & REPORTS )
10  CR 1 = IF " YOU HAVE WON " 1 WON +!
11  ELSE " SORRY - I'VE BEATEN YOU. "
12  THEN 1 TOTAL +! CR
13  " THE NUMBERS I CHOSE WERE "
14  NUMBERS @ 0 DO I NLIST ? LOOP ;
15


BLOCK : 94

0 ( MASTERMIND VERSION 0.2  5TH BLOCK OF 5 )
1 : RESULTS ( REPORTS GAMES WON )
2   CR " GAMES WON " WON ? " OUT OF " TOTAL ? ;
3 : AGAIN? 4 SPACES " ANOTHER GAME " Y/N ;
4 : PLAY ( INNER GAME LOOP )
5   PICK TRIES @ 0 DO
6   ASK COMPARE I REPORT WIN?
7   IF 1 LEAVE
8   THEN RESET
9   LOOP
10  WIN-OR-LOSE? RESULTS ;
11 : MASTERMIND ( MAIN LOOP )
12   RESET BEGIN
13   INITIALISE PLAY AGAIN?
14   END ; MASTERMIND ( EXECUTE WHEN LOADED )
15
```

All £ signs in the above should be typed in as upper-case 3.

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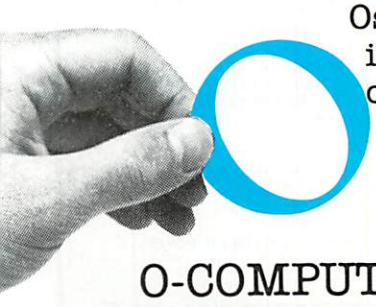

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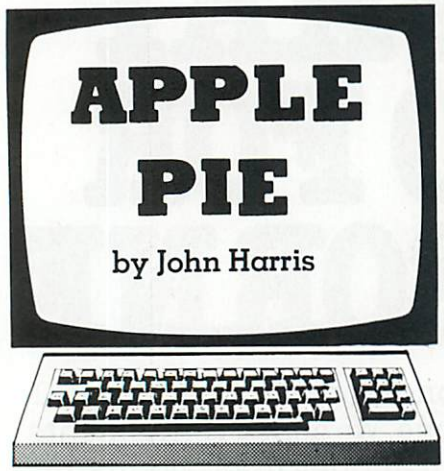


Clock-face and Vibraphone

GRAHAM WILSON of Clifton is becoming a regular contributor to this column. This month he has submitted a program which sets a clock face in motion on the screen, and a vibraphone implementation in which you can enter a musical score, and then edit, save, recall, list and play it.

The clock face appears to be accurate within the limitations of the individual Apple clocking rate variations. Mr Wilson originally coded the program for use as a dark-room timer since he found the amber screen suitable for use as a safe-light. I'm not sure that I would let my messy dark-room habits quite so close to my Apple, though.

Changing the shape table permits other clock faces to be generated. Message prompts can be created by drawing on high-resolution page 2.

Why it is that Apple users work so hard to generate music on their machines baffles me, considering that of all micros it is the least able to sound musical. I have run the Vibraphone program — as I have run the other musical concoctions that have occasionally appeared here — and I am sure that the sympathetic vibration of the casing can be doing no good at all.

This particular offering goes one stage further than the others in taking input from paddle 0 instead of the keyboard to give an analogue pitch control. I am incapable of maintaining any semblance of absolute pitch, so the end of my efforts bore little resemblance to their beginnings, regardless of the representation of a piano keyboard drawn on the screen as a guide. Even the normally tolerant cat left home for the duration.

The chief benefit in this program is the ease of selecting note length. There is no way of being musically creative when every note comes out the same length, and even less if they emerge unselectively different. The saving, loading and editing are commendably thorough and simple to use. My doubts concern the intent, rather than the execution.

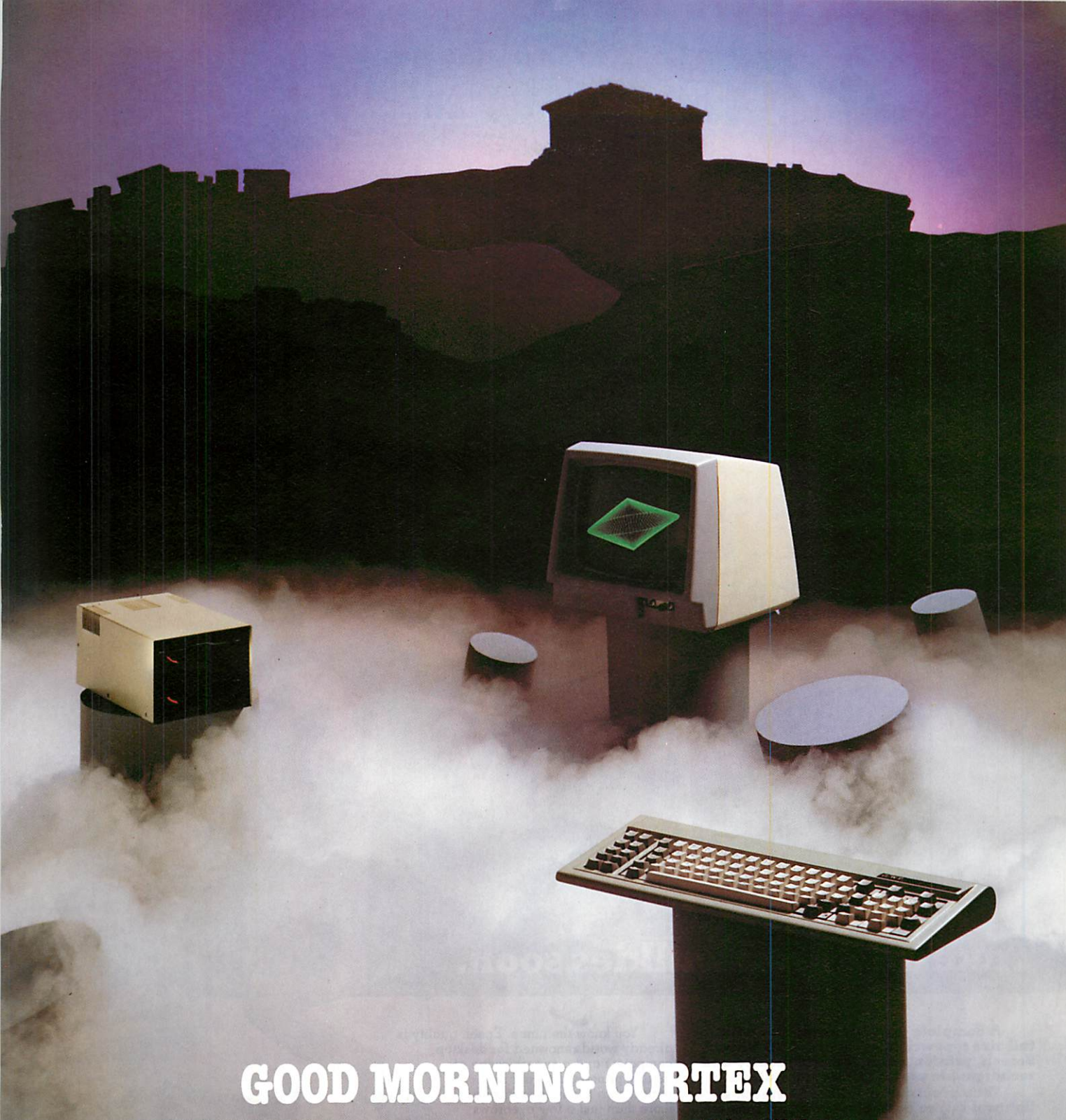
Clock face.

```
500  REM  CLOCK FACE
505  REM  GBW   1983
1000  REM
1005  REM  VARIABLES
1010  REM
1015  REM   H,MN,S...START TIME
1020  REM   XI,YI....SHAPE I DRAW
     POINT
1025  REM   RH,RM,RS.SHAPE ROTATI
     ONS
1030  REM   LC.......SHAPE TABLE
     LOCATIONS
1035  REM   BT.......SHAPE TABLE
     BITS
1040  REM   INC......INCREMENT TO
     TAL
1045  REM   I........INCREMENT CO
     UNT
1050  REM   B........FIRST RUN LA
     BEL
1500  REM
1505  REM  SET SCREEN POSITION
1510  REM
1515 X1 = 140
1520 Y1 = 81
1525 X2 = X1
1530 Y2 = Y1
1535 X3 = X1
1540 Y3 = Y1
1545 INC = 529
2000  REM
2005  REM  INITIALIZE CLOCK
2010  REM
2015  TEXT : HOME
2020  INVERSE : PRINT "CLOCK": NORMAL

2025  PRINT : PRINT "START TIME"
2030  INPUT "HOUR......:";H
2035  INPUT "MINUTES...:";MN
2040  INPUT "SECONDS...:";S
2500  REM
2505  REM  LOAD SHAPE TABLES
2510  REM
2515  POKE 232,0: POKE 233,3
2520  FOR LC = 768 TO 785
2525  READ BT
2530  POKE LC,BT
2535  NEXT LC
2540  DATA  3,0,8,0,10,0,12,0
2545  DATA  4,0,36,0,8,24,32,0
2550  DATA  0,0
3000  REM
3005  REM  MAIN PROGRAM
3010  REM
3015  REM
3500  REM  *** DISPLAY CLOCK
3505  HGR : HCOLOR= 3: SCALE= 20
3510  POKE  - 16302,0
3515 B = 1: REM  FIRST RUN LABEL
3520  GOSUB 4000: REM  DRAW HANDS

3525  GOSUB 6000: REM  COUNTER
3530 S = S + 1
3535  IF S = 60 THEN :MN = MN + 1
     :S = 0
3540  IF MN = 60 THEN :H = H + 1:
     MN = 0
3545  IF H = 13 THEN :H = 0
3550  GOSUB 5505
3555  GOTO 3520
4000  REM  DISPLAY HANDS
4005  IF B = 1 THEN : GOTO 5000: REM
       SKIPS UNDRAW ON FIRST RUN
4010  IF S <  > 0 THEN : RETURN
4500  REM  UNDRAW HANDS
4505  ROT= RH
4510  XDRAW 1 AT X1,Y1
4515  ROT= RM
4520  XDRAW 2 AT X2,Y2
5000  REM  DRAW HANDS
5005 RM = MN * 64 / 60
5010  ROT= RM
5015  DRAW 2 AT X2,Y2
5020 RH = H * 64 / 12
5025  ROT= RH
5030  DRAW 1 AT X1,Y1
5035  RETURN
5500  REM  SECONDS DISPLAY
5505  IF B = 1 THEN :B = 0: GOTO
     5515
5510  ROT= RT: XDRAW 3 AT X3,Y3
5515 RT =  INT (S * 64 / 60)
5520  ROT= RT: DRAW 3 AT X3,Y3
5525  RETURN
6000  REM  COUNTER
6005  FOR I = 1 TO INC
6010  NEXT I
6015  RETURN
```

Vibraphone.

```
10  REM
15  REM  APPLE-VIBROPHONE
20  REM
25  REM  GRAHAM B. WILSON
30  REM
35  REM  27 FEB 1983
50  REM
55  TEXT : HOME : CLEAR
99  REM
100  REM   *** INITIALIZE
101  REM
105 D$ =  CHR$ (13) +  CHR$ (4)
110  DIM A(500,2)
115  GOSUB 3000
120 I = 0
125 M = I
126  IF G = 4 GOTO 170
129  REM
130  REM  *** MENU
131  REM
135  TEXT : HOME : PRINT "OPTIONS
     ": PRINT "*******"
136  PRINT "1.......ENTER": PRINT

137  PRINT "2.......LISTEN": PRINT

138  PRINT "3.......PRINT": PRINT

139  PRINT "4.......RESTART": PRINT

140  PRINT "5.......SAVE": PRINT

141  PRINT "6.......LOAD": PRINT

142  PRINT "7.......SAME TUNE": PRINT

145  INPUT "SELECT ONE :- ";G
149  IF G > 7 GOTO 145
150  ON G GOTO 185,1000,1200,155,
     5000,6000,170
151  GOTO 145
154  REM
155  REM  *** RESTART OPTION
156  REM
160  RESTORE
165  GOTO 120
169  REM
170  REM  *** SAME TUNE OPTION
171  REM
175  GOSUB 3000
179  REM
180  REM  *** ENTER EACH TONE
181  REM
185  GOSUB 3020
190  GOSUB 3105
194  REM
195  REM  *** CHECK FOR TERMINATO
     R
196  REM
200  IF X1 = 0 AND Y1 = 0 THEN I =
     I - 1: GOTO 225
204  REM
205  REM  *** TONE STORE
206  REM
210 A(I,1) = F:A(I,2) = D
215 I = I + 1
220 M = I: GOTO 190
224  REM
225  REM   *** TONE CHANGES
226  REM
230  PRINT "CHANGE NOTE £ <0-";I;
     "> ";
235  INPUT E$: IF E$ = "" THEN 19
     0
240  IF E$ = "N" THEN : GOTO 135
245 E =  VAL (E$)
250  IF E < 0 OR E > I THEN 225
255 M = E: GOSUB 3105:M = I
260 A(E,1) = F:A(E,2) = D: GOTO 2
     30
999  REM
1000  REM   *** LISTEN SUBR.
1001  REM
1010  FOR K = 0 TO I
1020 F = A(K,1):D = A(K,2): GOSUB
     3185
1030  NEXT K
1040  GOTO 135
1199  REM
1200  REM   *** LIST TONES
1201  REM
1210  HOME
1220  PRINT "NOTE£","FREQ","DURAT
     ION"
1230  FOR K = 0 TO I
1240  PRINT K,A(K,1),A(K,2)
1250  IF K > 0 AND (K / 10) =  INT
     (K / 10) THEN : PRINT "PRESS
      <ANY KEY> TO CONTINUE": INPUT
     "";G$: HOME
1260  NEXT K
1270  PRINT
1280  PRINT "PRESS <RETURN> TO CO
     NTINUE": INPUT Z$
1290  GOTO 135
2999  REM
3000  REM  *** MUSIK MAKER POKER
3001  REM
3005  RESTORE
```

(listing continued on page 177)



GOOD MORNING CORTEX

C/WP CONTEXT has changed its name to CORTEX – but it's still the same powerful, cost effective, easy-to-use twin-processor microcomputer (faster in basic bench marks than IBM PC® or Sirius). CORTEX has superb graphics and C/WP's new version WordStar – best of the word processing software.

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C/WP CORTEX

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PC7/20

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Boolean tutorial

The arrival of this demonstration program from Mr J J Taylor of Teignmouth, Devon brings to a head the question of assembler representation within Apple Pie. The program visually represents the decimal, binary, hex and character notation of ASCII, together with And, Or, EOr and the Shift/Rotate operations.

The program is essentially assembler coded and sits in a Basic frame which does little but provide the screen text surround and call the object code. As a tutorial it is excellent, but anyone meaning to load and run it is only going to key the object code direct and not compile the source from scratch as that takes so much longer to type up.

By printing only the object machine code and not the assembler source, those who can read and benefit from the assembler techniques it uses are denied the chance to do so with the full labels, notes and comments. However, since assembler source takes so much space by comparison with the object code, and is of utility to so few, it will not be printed in the magazine. If you do want it please write in, enclosing a self-addressed envelope, and the assembler source listing and relevant notes will be sent to you.

Connect Four

A version of this well-known two-player game has been submitted by M C Prior of Aldershot. The high-resolution screen is used for a graphics representation which is well designed and easily followed. My own tactics are not good enough to beat anyone at the game but I enjoyed making the attempt.

(listing continued from page 174)

```
3010  FOR MP = 880 TO 900: READ D
      : POKE MP,D: NEXT
3015  RETURN
3019  REM
3020  REM  *** TONE INPUT
3021  REM
3025  REM  DRAW KEY
3030  GR : COLOR= 15
3035  READ E
3040  FOR LN = 1 TO 8
3045  READ S,C
3050  HLIN S,E AT C
3055  NEXT LN
3060  FOR LN = 1 TO 2
3065  READ S,E,C
3070  VLIN S,E AT C
3075  NEXT LN
3080  FOR LN = 1 TO 23
3085  READ X,Y
3090  PLOT X,Y
3095  NEXT LN
3100  RETURN
3105  REM  READ FREQUENCY
3110 X1 =  PDL (0)
3115 X2 = 30 -  INT (X1 * 24 / 25
      5)
3120 X3 = 10 ^ ((X1 * 24 * 0.0251
      / 255) + 1.7782)
3125  PLOT X2,10
3130  IF  PEEK ( - 16287) < 128 THEN
      : COLOR= 0: PLOT X2,10: COLOR=
      15: GOTO 3105
3135 F = X3
3140  REM  READ DURATION
3145 Y1 =  PDL (1)
3150 Y2 = 31 -  INT (Y1 * 15 / 25
      5)
3155  PLOT 34,Y2
3160  IF  PEEK ( - 16286) < 128 THEN
      : COLOR= 0: PLOT 34,Y2: COLOR=
      15: GOTO 3140
3165 D = Y1
3170  IF (F < 0 OR F > 255) OR (D
      < 0 OR D > 255) THEN : COLOR=
      0: PLOT 34,Y2: PLOT X2,10: COLOR=

      15: GOTO 3105
3175  GOSUB 3185
3180  RETURN
3184  REM
3185  REM  *** SPEAKER DRIVER
3186  REM
3190  POKE 878,F
3195  POKE 879,D
3200  CALL 880
3205  RETURN
4999  REM
5000  REM  *** SAVE SUBR.
5001  REM
5010  HOME
5020  PRINT "NAME FOR FILE :-": INPUT
      "";G$
5030  PRINT "DRIVE £ <DEFAULT = 1
      > :-": INPUT "";DV$: IF DV$ =
      "" THEN :G = 1: GOTO 5050
5040 G =  VAL (DV$)
5050  HOME : INVERSE : PRINT "SAV
      ING": NORMAL
5060  PRINT D$;"OPEN";G$;",D";G
5070  PRINT D$;"DELETE";G$
5080  PRINT D$;"OPEN";G$
5090  PRINT D$;"WRITE";G$
5100  PRINT I
5110  FOR K = 0 TO I
5120  PRINT K
5130  PRINT A(K,1)
5140  PRINT A(K,2)
5150  NEXT K
5160  PRINT D$;"CLOSE";G$
5170  GOTO 135
5999  REM
6000  REM  *** LOAD SUBR.
6001  REM
6010  HOME
6020  PRINT "NAME OF FILE :-": INPUT
      "";G$
6030  PRINT "DRIVE £ <DEFAULT = 1
      > :-": INPUT "";DV$: IF DV$ =
      "" THEN :G = 1: GOTO 6050
6040 G =  VAL (DV$)
6050  HOME : INVERSE : PRINT "LOA
      DING": NORMAL
6060  PRINT D$;"OPEN";G$;",D";G
6070  PRINT D$;"READ";G$
6080  INPUT I
6090  FOR K = 0 TO I
6100  INPUT K
6110  INPUT A(K,1)
6120  INPUT A(K,2)
6130  NEXT K
6140  PRINT D$;"CLOSE";G$
6150  GOTO 135
8999  REM
9000  REM  *** DATA LINES
9001  REM
9010  DATA  173,48,192,136,208,5.
      206,111
9020  DATA  3,240,9,202,208,245,1
      74,110
9030  DATA  3,76,112,3,96
9040  DATA  31,5,3,5,7,16,17,20,1
      9,24,21,26,23,28,25,29,27
9050  DATA  4,6,5,4,6,31
9060  DATA  7,4,7,5,10,4,10,5,12,
      4,12,5,15,4,15,5,17,4,17,5
9070  DATA  19,4,19,5,22,4,22,5,2
      4,4,24,5,27,4,27,5,29,4,29,5

9080  DATA  30,29,31,29,31,31
9999  END
```

Boolean tutorial.

```
10  HOME
20  IF  PEEK ( - 16287) > 127 THEN
      IF  PEEK ( - 16286) > 127 THEN
      VTAB 10: PRINT "THIS PROGRA
      M NEEDS GAMES PADDLES !!": END

30 D$ =  CHR$ (4)
35  PRINT D$;"BLOAD BOOLEANPDL.OB
      J"
40  PRINT "BOOLEAN LOGICAL OPERAT
      IONS"
50  PRINT "----------------------
      -----"
60  VTAB 3: HTAB 16: PRINT "DEC.
      HEX. BINARY  CHAR."
70  VTAB 4: HTAB 16: PRINT "-----
      ------------------"
80  VTAB 5: PRINT "READ PDL(0):-"

90  VTAB 6: PRINT "READ PDL(1):-"

100  VTAB 8: PRINT "READ PDL(0):-
      "
110  PRINT "--------------"
120  PRINT "'AND' PDL(1)="
130  PRINT " 'OR' PDL(1)="
140  PRINT "'EOR' PDL(1)="
150  VTAB 14: PRINT "SHIFT/ROTATE
      OPERATIONS"
160  PRINT "----------------------
      --"
170  HTAB 16: PRINT "DEC. HEX. BI
      NARY  CHAR."
180  HTAB 16: PRINT "-------------
      ------------"
190  PRINT "'ASL' PDL(0)="
200  PRINT "'LSR' PDL(0)="
210  PRINT "'ROL' PDL(0)="
220  PRINT "'ROR' PDL(0)="
230  VTAB 23: PRINT "PRESS ESCAPE
      KEY TO EXIT."
240  CALL 24576
250  REM   BY J.J.TAYLOR.TEIGNMOU
      TH.DEVON
```

Boolean tutorial — object code.

```
6000- A9 04 85 1A A9 05 85 1B
6008- A2 00 20 B0 60 85 07 A9
6010- 0F 85 24 A5 1A 20 BD 60
6018- 20 D6 60 20 ED 60 20 17
6020- 61 A5 07 20 ED FD A2 01
6028- 20 B0 60 85 08 A9 0F 85
6030- 24 A5 1B 20 BD 60 20 D6
6038- 60 20 ED 60 20 17 61 A5
6040- 08 20 ED FD A5 07 25 08
6048- 85 0A 20 F9 60 A9 09 20
6050- 0D 61 A5 07 05 08 85 0A
6058- 20 F9 60 A9 0A 20 0D 61
6060- A5 07 45 08 85 0A 20 F9
6068- 60 A9 0B 20 0D 61 A5 07
6070- 0A 85 0A 20 F9 60 A9 11
6078- 20 0D 61 A5 07 4A 85 0A
6080- 20 F9 60 A9 12 20 0D 61
6088- 18 A5 07 2A 85 0A 20 F9
6090- 60 A9 13 20 0D 61 A5 07
6098- 6A 85 0A 20 F9 60 A9 14
60A0- 20 0D 61 AD 00 C0 2C 10
60A8- C0 C9 9B F0 46 4C 08 60
60B0- A9 C3 20 A8 FC 20 1E FB
60B8- 98 AA 85 06 60 20 5B FB
60C0- A9 A4 20 ED FD 20 44 F9
60C8- 20 ED 60 A6 06 86 44 20
60D0- 42 AE 20 ED 60 60 A2 08
60D8- A5 06 0A 85 06 B0 05 A9
60E0- B0 4C E6 60 A9 B1 20 ED
60E8- FD CA D0 EC 60 A2 02 20
60F0- 4A F9 60 20 58 FC 4C 03
60F8- E0 85 06 AA A9 0F 85 24
6100- 60 20 ED 60 20 17 61 A5
6108- 0A 20 ED FD 60 20 BD 60
6110- 20 D6 60 20 01 61 60 A9
6118- A0 20 ED FD A9 C2 20 2C
6120- FC 60
*2D0G
```

Connect Four.

```
1  REM  CONNECT FOUR, WRITTEN BY
     M.C.PRIOR
2  DIM A(8,8),B$(2),C(2)
3  GOSUB 100
4 C(0) = 4:C(1) = 9: REM  SET COL
     OURS
5  HOME
6  VTAB 6
7  PRINT "      CONNECT FOUR": PRINT

8  PRINT "      FOR TWO PLAYERS": PRINT


9  PRINT "TRY TO LINK TOGETHER 4
     OF YOUR MARKERS, & AT THE SA
     ME TIME PREVENT YOUR
      OPPONENT FROM DOING THE SAM
     E"
10  FOR Z = 0 TO 6000: NEXT
11  HOME : INPUT "FIRST PLAYER'S
     NAME ";B$(0)
12  INPUT "SECOND PLAYERS NAME ";
     B$(1)
13  REM  DRAW GRID
14  HOME : GR : COLOR= 15
15  FOR X = 2 TO 34 STEP 4
16  HLIN 2,34 AT X + 2
17  VLIN 4,36 AT X
18  NEXT X
19  REM  NUMBER THE COLUMNS
20  FOR Z = 4 TO 32 STEP 4
21  PRINT  TAB( Z + 1);Z / 4;
22  NEXT : PRINT
23  PRINT
24  PRINT B$(0);" YOUR GO, WHICH
     COLUMN? ";
25  GET C$: IF C$ = "" THEN 25
26 X =  VAL (C$)
27  IF X = 0 THEN  TEXT : HOME : END
```

(listing continued on next page)

Undelete

THREE LINES into Gordon Horsington's covering letter to this utility I found my teeth grinding. Three months too late, I thought, since I lost a whole day through deleting the only remaining copy of an unlisted source and found myself ferreting through sectors and tracks, regenerating the program with pen and ink. I consoled myself with the fact that it has now arrived in time for the next occasion.

Undelete will operate on directory entries within DOS 3.3 which have been deleted with the DOS Delete command. The program can be run from any drive but it will only undelete files under slot 6 drive 1, a restriction indicated while running.

The program first Catalogs the disc and puts an inverse-video character alongside any file that has been deleted and may be undeleted. The operator is then given the option to proceed. On receiving the answer Yes, the program undeletes all the deleted files on drive 1 and Catalogs the disc. If the files cannot be undeleted — say, if the disc is write protected — the program ends without the second Catalog.

If all has gone well and the directory is reinstated, the undeleted files should be loaded and saved on another disc before reusing the undeleted disc. I think I would re-Init it after retrieving what I could, just to be safe.

Round the bend

A blob-chasing game inside what seems to be a four-roomed bungalow with a central hallway has been submitted by Graham Giller of Coventry.

The grey blobs shuffle around and eventually allow you to catch them. At that point they reveal whether they are good grey blobs, by adding 10 points to your score, or mouldy blobs, by deducting points instead. The trick lies in remembering which blobs are which, since they then wander a little way off and recommence shuffling in an enticing way.

The game ends when you reach a designated credit score or sink below zero. Since winning involves the accumulation of 150 points the game embodies the fascinating notion that, however hard you try, you might lose anyway — as cynical a representation of life as ever you could hope to meet in a soulless machine.

(listing continued from previous page)

```
28  PRINT
29  IF X < 1 OR X > 8 THEN 24
30  COLOR= C(Q)
31  REM  CHECK FOR LOWEST VACANT
     SQUARE
32  FOR Y = 8 TO 1 STEP  - 1
33 J = X * 4:K = Y * 4 + 2
34  IF A(X,Y) = 2 THEN A(X,Y) = Q
     : GOSUB 102: GOTO 37
35  NEXT Y
36  PRINT "COL. FULL!!": GOTO 24
37 Q =  ABS (Q - 1)
38  FOR Z = 0 TO 4: PRINT : NEXT

39  REM  CHECK ADJACENT SQ.S, SEE
     IF 4 CONNECTED
40  FOR E = 1 TO 8
41 T = 1:X1 = X:Y1 = Y
42  ON E GOSUB 45,51,57,63,69,75,
    81,87
43  NEXT E
44  GOTO 20
45 X = X1:Y = Y1
46  IF X + 1 > 8 THEN 93
47  IF A(X + 1,Y) <  > A(X,Y) THEN
     93
48  IF A(X + 1,Y) = A(X,Y) THEN T
     = T + 1:X = X + 1
49  IF T = 4 THEN 94
50  GOTO 46
51 X = X1:Y = Y1
52  IF X - 1 < 1 THEN 93
53  IF A(X - 1,Y) <  > A(X,Y) THEN
     93
54  IF A(X - 1,Y) = A(X,Y) THEN T
     = T + 1:X = X - 1
55  IF T = 4 THEN 94
56  GOTO 52
57 X = X1:Y = Y1
58  IF Y + 1 > 8 THEN 93
59  IF A(X,Y + 1) <  > A(X,Y) THEN
     93
60  IF A(X,Y + 1) = A(X,Y) THEN T
     = T + 1:Y = Y + 1
61  IF T = 4 THEN 94
62  GOTO 58
63 X = X1:Y = Y1
64  IF Y - 1 < 1 THEN 93
65  IF A(X,Y - 1) <  > A(X,Y) THEN
     93
66  IF A(X,Y - 1) = A(X,Y) THEN T
     = T + 1:Y = Y - 1
67  IF T = 4 THEN 94
68  GOTO 64
69 X = X1:Y = Y1
70  IF X + 1 > 8 OR Y + 1 > 8 THEN
     93
71  IF A(X + 1,Y + 1) <  > A(X,Y)
     THEN 93
72  IF A(X + 1,Y + 1) = A(X,Y) THEN
     T = T + 1:X = X + 1:Y = Y +
    1
73  IF T = 4 THEN 94
74  GOTO 70
75 X = X1:Y = Y1
76  IF X + 1 > 8 OR Y - 1 < 1 THEN
     93
77  IF A(X + 1,Y - 1) <  > A(X,Y)
     THEN 93
78  IF A(X + 1,Y - 1) = A(X,Y) THEN
     T = T + 1:X = X + 1:Y = Y -
    1
79  IF T = 4 THEN 94
80  GOTO 76
81 X = X1:Y = Y1
82  IF X - 1 < 1 OR Y + 1 > 8 THEN
     93
83  IF A(X - 1,Y + 1) <  > A(X,Y)
     THEN 93
84  IF A(X - 1,Y + 1) = A(X,Y) THEN
     T = T + 1:X = X - 1:Y = Y +
    1
85  IF T = 4 THEN 94
86  GOTO 82
87 X = X1:Y = Y1
88  IF X - 1 < 1 OR Y - 1 < 1 THEN
     93
89  IF A(X - 1,Y - 1) <  > A(X,Y)
     THEN 93
90  IF A(X - 1,Y - 1) = A(X,Y) THEN
     T = T + 1:X = X - 1:Y = Y -
    1
91  IF T = 4 THEN 94
92  GOTO 88
93 T = 0: RETURN
94  PRINT B$( ABS (Q - 1));" WINS
     !!!"
95  PRINT : PRINT "PLAY AGAIN?
    ";: INPUT Z$
96  IF  LEFT$ (Z$,1) = "N" THEN  TEXT
     : HOME : END
97  IF  LEFT$ (Z$,1) <  > "Y" THEN
     95
98  TEXT : HOME : GOSUB 100
99  GOTO 11
100  FOR X = 0 TO 8: FOR Y = 0 TO
    8:A(X,Y) = 2: NEXT Y,X
101  RETURN
102  IF Q = 1 THEN 109
103  PLOT J - 1,K - 1
104  PLOT J + 1,K - 1
105  PLOT J,K
106  PLOT J - 1,K + 1
107  PLOT J + 1,K + 1
108  GOTO 114
109  PLOT J - 1,K
110  PLOT J,K
111  PLOT J + 1,K
112  PLOT J,K - 1
113  PLOT J,K + 1
114  RETURN
```

Undelete.

```
10  REM  UNDELETE DOS 3.3
20 :
100  TEXT : HOME :D$ =  CHR$ (13)
      + CHR$ (4)
110  PRINT "PLACE DISK IN DRIVE1
     AND PRESS RETURN ";
120  GET AN$: HOME
130  POKE 44505,234: POKE 44506,2
     34
140  PRINT D$;"CATALOG,D1,S6,V0"
150  POKE 44505,48: POKE 44506,74

160  PRINT : INPUT "UNDELETE FILE
     S (Y/N) ";AN$
170  IF  LEFT$ (AN$,1) <  > "Y" THEN
      END
180  FOR A1 = 1 TO 27: READ A2,A3
     : POKE A2,A3: NEXT
190  FOR A4 = 0 TO 15: GOSUB 350
200  FOR A1 = 1 TO 7: GOSUB 270
210  IF  PEEK (A2 - 3) <  > 255 THEN
     240
220  POKE (A2 - 3),( PEEK (A2 + 2
     9)): POKE (A2 + 29),160: POKE
     3094,2
230  GOSUB 360
240  NEXT
250  NEXT
260  PRINT D$;"CATALOG": END
270  ON A1 GOTO 280,290,300,310,3
     20,330,340
280 A2 = 8206: RETURN
290 A2 = 8241: RETURN
300 A2 = 8276: RETURN
310 A2 = 8311: RETURN
320 A2 = 8346: RETURN
330 A2 = 8381: RETURN
340 A2 = 8416: RETURN
350  POKE 3087,A4: POKE 3094,1
360  CALL 3072:A3 =  PEEK (3095)
370  IF A3 = 16 OR A3 = 32 OR A3 =
     64 OR A3 = 128 THEN  END
380  RETURN
390  DATA  3072,169,3073,12,3074
     ,160,3075,10,3076,32,3077,21
     7,3078,3,3079,96,3082,1,3086
     ,17,3084,1,3085,0,3088,32
400  DATA  3089,12,3090,0,3091,3
     2,3092,0,3093,0,3095,0,3096,
     0,3097,96,3098,1,3104,0,3105
     ,1,3106,239,3107,216,3083,96
```

Round the bend.

```
5  TEXT
10  REM  ******************
20  REM  **                **
30  REM  **    'ROUND      **
40  REM  **   THE BEND     **
50  REM  **     A GAME     **
60  REM  **                **
70  REM  ******************
80  REM  BY G.L.GILLER
90  REM  (C)COPYRIGHT 23:1:83
100  GOTO 30000
110  RESTORE : CLEAR : HOME : GR
     : COLOR= 15
115 K = 10
116 ZZZ =  INT ( RND (1) * 4 + 1)

117  REM  ** SCREEN
120  READ A,B,C
130  IF A =  - 90 THEN 200
140  HLIN A,B AT C
150  GOTO 120
160  DATA  1,38,3,1,38,36,2,8,22,
     12,20,22,-90,0,0
200  READ A,B,C
210  IF A =  - 90 THEN 250
220  VLIN A,B AT C
230  GOTO 200
240  DATA 3,36,1,3,36,38,3,19,10,
     25,36,10,10,22,20,3,19,25,20
     ,36,30,3,36,38,-90,0,0
250  COLOR= 0
260  PLOT 10,10: PLOT 10,9: PLOT
     10,7: PLOT 10,8
270  REM  ** SET MEN
300 A =  INT ( RND (1) * 30 + 4)
310 B =  INT ( RND (1) * 30 + 4)
320 C =  INT ( RND (1) * 30 + 4)
330 D =  INT ( RND (1) * 30 + 4)
340 E =  INT ( RND (1) * 30 + 4)
350 F =  INT ( RND (1) * 30 + 4)
360 G =  INT ( RND (1) * 30 + 4)
370 H =  INT ( RND (1) * 30 + 4)
380 I =  INT ( RND (1) * 30 + 4)
390 J =  INT ( RND (1) * 30 + 4)
400 L = 18:M = 28
410  HOME : VTAB 21: PRINT "SCORE
     = ";K;" HI-SCORE = ";HK
415  REM  ** PLOT GREY MEN
417  COLOR= 16
420 N =  SCRN( A,B)
430  IF N = 15 THEN 450
440  GOTO 500
450 A = A + 1
460  GOTO 420
500  PLOT A,B
510 N =  SCRN( C,D)
520  IF N = 15 THEN 540
530  GOTO 600
540 C = C + 1
550  GOTO 510
600  PLOT C,D
610 N =  SCRN( E,F)
```

(listing continued on page 180)

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221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244
245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268
269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292
293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316
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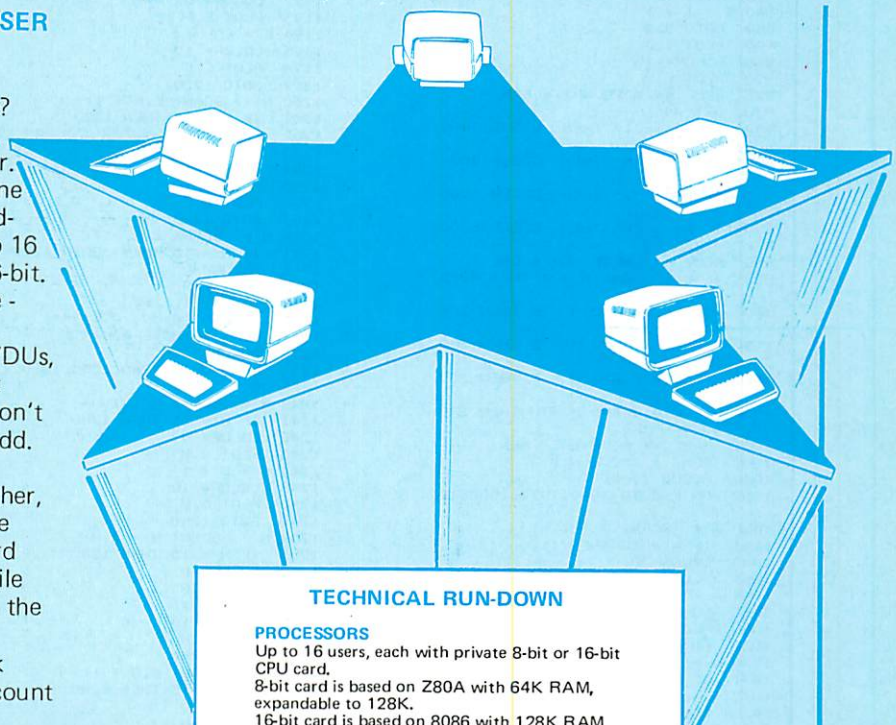

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(listing continued from page 178)

```
620  IF N = 15 THEN 640
630  GOTO 700
640 E = E + 1
650  GOTO 610
700  PLOT E,F
710 N =  SCRN( G,H)
720  IF N = 15 THEN 740
730  GOTO 800
740 G = G + 1
750  GOTO 710
800  PLOT G,H
810 N =  SCRN( I,J)
820  IF N = 15 THEN 840
830  GOTO 900
840 I = I + 1
850  GOTO 810
900  PLOT I,J
910  COLOR= 15
920  PLOT L,M
925  REM  ** MOVE WHITE MAN
930  GET A$
940  IF A$ = "I" THEN  GOSUB 3000

950  IF A$ = "M" THEN  GOSUB 4000

960  IF A$ = "J" THEN  GOSUB 5000

970  IF A$ = "K" THEN  GOSUB 6000

980  REM  ** CHECK FOR SCORE
990  IF L = I AND M = J THEN 4000
     0
1000  IF L = A AND M = B THEN 200
     10
1010  IF L = C AND M = D THEN 200
     20
1020  IF L = E AND M = F THEN 200
     30
1030  IF L = G AND M = H THEN 200
     40
1031  REM  ** MOVE GREY MEN
1032  REM  *  MOVE A,B
1040  GOSUB 7000
1050  ON P GOTO 1060,1070,1080,10
     90
1060 N =  SCRN( A + 1,B)
1061  IF N = 15 THEN 1100
1062  COLOR= 0
1063  PLOT A,B
1064 A = A + 1
1065  COLOR= 10
1066  PLOT A,B
1067  GOTO 1100
1070 N =  SCRN( A - 1,B)
1071  IF N = 15 THEN 1100
1072  COLOR= 0
1073  PLOT A,B
1074 A = A - 1
1075  COLOR= 10
1076  PLOT A,B
1077  GOTO 1100
1080 N =  SCRN( A,B + 1)
1081  IF N = 15 THEN 1100
1082  COLOR= 0
1083  PLOT A,B
1084 B = B + 1
1085  COLOR= 10
1086  PLOT A,B
1087  GOTO 1100
1090 N =  SCRN( A,B - 1)
1091  IF N = 15 THEN 1100
1092  COLOR= 0
1093  PLOT A,B
1094 B = B - 1
1095  COLOR= 10
1096  PLOT A,B
1097  REM  *  MOVE C,D
1100  GOSUB 7000
1110  ON P GOTO 1120,1130,1140,11
     50
1120 N =  SCRN( C + 1,D)
1121  IF N = 15 THEN 1160
1122  COLOR= 0
1123  PLOT C,D
1124 C = C + 1
1125  COLOR= 10
1126  PLOT C,D
1127  GOTO 1160
1130 N =  SCRN( C - 1,D)
1131  IF N = 15 THEN 1160
1132  COLOR= 0
1133  PLOT C,D
1134 C = C - 1
1135  COLOR= 10
1136  PLOT C,D
1137  GOTO 1160
1140 N =  SCRN( C,D + 1)
1141  IF N = 15 THEN 1160
1142  COLOR= 0
1143  PLOT C,D
1144 D = D + 1
1145  COLOR= 10
1146  PLOT C,D
1150 N =  SCRN( C,D - 1)
1151  IF N = 15 THEN 1160
1152  COLOR= 0
1153  PLOT C,D
1154 D = D - 1
1155  COLOR= 10
1156  PLOT C,D
1157  REM  *  MOVE E,F
1160  GOSUB 7000
1170  ON P GOTO 1180,1190,1200,12
     10
1180 N =  SCRN( E + 1,F)
1181  IF N = 15 THEN 1220
1182  COLOR= 0
1183  PLOT E,F
1184 E = E + 1
1185  COLOR= 10
1186  PLOT E,F
1187  GOTO 1220
1190 N =  SCRN( E - 1,F)
1191  IF N = 15 THEN 1220
1192  COLOR= 0
1193  PLOT E,F
1194 E = E - 1
1195  COLOR= 10
1196  PLOT E,F
1197  GOTO 1220
1200 N =  SCRN( E,F + 1)
1201  IF N = 15 THEN 1220
1202  COLOR= 0
1203  PLOT E,F
1204 F = F + 1
1205  COLOR= 10
1206  PLOT E,F
1207  GOTO 1220
1210 N =  SCRN( E,F - 1)
1211  IF N = 15 THEN  GOTO 1220
1212  COLOR= 0
1213  PLOT E,F
1214 F = F - 1
1215  COLOR= 10
1216  REM  *  MOVE G,H
1220  GOSUB 7000
1230  ON P GOTO 1240,1250,1260,12
     70
1240 N =  SCRN( G + 1,H)
1241  IF N = 15 THEN 1280
1242  COLOR= 0
1243  PLOT G,H
1244 G = G + 1
1245  COLOR= 10
1246  PLOT G,H
1247  GOTO 1280
1250 N =  SCRN( G - 1,H)
1251  IF N = 15 THEN 1280
1252  COLOR= 0
1253  PLOT G,H
1254 G = G - 1
1255  COLOR= 10
1256  PLOT G,H
1257  GOTO 1280
1260 N =  SCRN( G,H + 1)
1261  IF N = 15 THEN 1280
1262  COLOR= 0
1263  PLOT G,H
1264 H = H + 1
1265  COLOR= 10
1266  PLOT G,H
1267  GOTO 1280
1270 N =  SCRN( G,H - 1)
1271  IF N = 15 THEN 1280
1272  COLOR= 0
1273  PLOT G,H
1274 H = H - 1
1275  COLOR= 10
1276  PLOT G,H
1277  REM  *  MOVE I,J
1280  GOSUB 7000
1290  ON P GOTO 1300,1310,1320,13
     30
1300 N =  SCRN( I + 1,J)
1301  IF N = 15 THEN 1340
1302  COLOR= 0
1303  PLOT I,J
1304 I = I + 1
1305  COLOR= 10
1306  PLOT I,J
1307  GOTO 1340
1310 N =  SCRN( I - 1,J)
1311  IF N = 15 THEN 1340
1312  COLOR= 0
1313  PLOT I,J
1314 I = I - 1
1315  COLOR= 10
1316  PLOT I,J
1317  GOTO 1340
1320 N =  SCRN( I,J + 1)
1321  IF N = 15 THEN 1340
1322  COLOR= 0
1323  PLOT I,J
1324 J = J + 1
1325  COLOR= 10
1326  PLOT I,J
1327  GOTO 1340
1330 N =  SCRN( I,J - 1)
1331  IF N = 15 THEN 1340
1332  COLOR= 0
1333  PLOT I,J
1334 J = J - 1
1335  COLOR= 10
1336  PLOT I,J
1337  HOME
1340  HOME : VTAB 21: PRINT "SCOR
     E = ";K;" HI-SCORE = ";HK
1350  REM  ** SET SCORE LIMIT
1361  IF ZZZ = 1 THEN XXX = 150
1362  IF ZZZ = 2 THEN XXX = 160
1363  IF ZZZ = 3 THEN XXX = 170
1364  IF ZZZ = 4 THEN XXX = 180
1365  REM  ** CHECK SCORE
1370  IF K > XXX THEN 40002
1380  GOTO 930
1390  REM  ** MOVE WHITE ROUTINES

1400  REM  *  UP
3000 Q =  SCRN( L,M - 1)
3010  IF Q = 15 THEN 3090
3020  COLOR= 0
3030  PLOT L,M
3040  COLOR= 15
3050 M = M - 1
3060  PLOT L,M
3090  RETURN
3095  REM  *  DOWN
4000 Q =  SCRN( L,M + 1)
4010  IF Q = 15 THEN 4090
4020  COLOR= 0
4030  PLOT L,M
4040  COLOR= 15
4050 M = M + 1
4060  PLOT L,M
4090  RETURN
4095  REM  *  LEFT
5000 Q =  SCRN( L - 1,M)
5010  IF Q = 15 THEN 5090
5020  COLOR= 0
5030  PLOT L,M
5040  COLOR= 15
5050 L = L - 1
5060  PLOT L,M
5090  RETURN
5095  REM  *  RIGHT
6000 Q =  SCRN( L + 1,M)
6010  IF Q = 15 THEN 6090
6020  COLOR= 0
6030  PLOT L,M
6040  COLOR= 15
6050 L = L + 1
6060  PLOT L,M
6090  RETURN
6095  REM  ** GREY RANDOM MOVEMEN
     T
7000 P =  INT ( RND (1) * 4 + 1)
7010  RETURN
7020  REM  ** RESET GOBBLED MEN
20010 K = K + 10:A = 5:B = 5
20011  GOTO 1040
20020 K = K + 10:C = 5:D = 5
20021  GOTO 1040
20030 K = K + 10:E = 5:F = 5
20031  GOTO 1040
20040 K = K + 10:G = 5:H = 5
20041  GOTO 1040
20100  REM  ** BEGINNING
30000  HOME
30010  VTAB 5
30020  HTAB 13
30030  INVERSE : PRINT "ROUND THE
      BEND": NORMAL
30040  PRINT : PRINT
30050  HTAB 10: PRINT "A GAME BY
       G. GILLER"
30060  HTAB 11: PRINT "(C) COPYRI
     GHT 1983"
30070  PRINT
30080  PRINT "THE OBJECT IS TO GE
     T OVER 150PTS.BEFORE YOUR LU
     CK RUNS OUT"
30090  PRINT
30100  PRINT "YOU ARE WHITE:YOU H
     AVE TO GOBBLE THE    GREY ME
     N"
30110  PRINT "BUT ONE GREY MAN DO
     ESN'T LIKE YOU AND   WILL PE
     NALISE YOU"
30120  HTAB 19: PRINT "SO"
30130  FLASH : HTAB 17: PRINT "BE
     WARE": NORMAL
30140  PRINT
30150  HTAB 15: PRINT " 'I' IS UP
     "
30160  HTAB 10: PRINT " 'J' IS LE
     FT'K' IS RIGHT"
30170  HTAB 15: PRINT " 'M' IS DO
     WN"
30180  PRINT
30190  PRINT "<PRESS RETURN WHEN
     READY>";: GET B$
30200  GOTO 110
30260  REM  ** END
40000  PRINT  CHR$ (7): IF K >  =
     0 THEN K = K - 10: GOTO 1000

40002  PRINT  CHR$ (7): HOME : PRINT
      TAB( 8);"YOUR LUCK RAN OUT"

40010  PRINT  TAB( 8)"YOUR SCORE
     WAS ";K
40020  PRINT  TAB( 8);"GO AGAIN(Y
     OR N)*";: GET Z$
40025  IF K > HK THEN HK = K
40029  IF K > HK THEN HK = K
40030  IF Z$ = "Y" THEN 110
40040  TEXT : HOME : END
```

Curve fitting

A COMMON REQUIREMENT in laboratories is the reduction of large quantities of experimental data to a more manageable equation by using curve fitting techniques, notes A D Wilson of Newcastle upon Tyne. Often simple linear or quadratic expressions are inadequate. A very powerful method is to fit to a number, W, of x,y data pairs a polynomial of degree N, where N is not greater than W:

$$y = \sum_{i=0}^{N} V(i+1)x^i$$

using the least-squares criterion to obtain the function which best approximates the experimental data, a process which is often termed regression analysis.

This polynomial curve-fitting program is written for the Sinclair ZX-81 with 16K of memory. For clarity the code is written as a series of subroutines which are called by lines 10 to 100. In what follows it is assumed that the y values contain statistical errors, whereas the x values are known exactly. In this situation regression is said to be carried out on x.

Setting the derivatives of the sum of the square of the y deviations with respect to the polynomial coefficients equal to zero gives a set of normal equations. For a quadratic, N = 2, we would get

$$V(1)W + V(2)\sum x + V(3)\sum x^2 = \sum y$$

$$V(1)\sum x + V(2)\sum x^2 + V(3)\sum x^3 = \sum yx$$

$$V(1)\sum x^2 + V(2)\sum x^3 + V(3)\sum x^4 = \sum x^2y$$

which form a set of N + 1 simultaneous equations with N + 1 unknowns, V(i), and are thus exactly solvable.

The first step in the curve-fitting process is to generate the normal equations. The program does it in two stages. Subroutine 250 calculates all the Σx^j terms as F(1,J). For a polynomial of degree N there are 2N such terms. For example, N = 2 gives x, x^2, x^3, and x^4. Subsequently subroutine 400 sorts through the F(1,J) assigning them to the A(u,v) terms which allow identification of the specific row u and column v. In other words, the normal equations for a quadratic are rewritten as:

$$V(1)A11 + V(2)A12\ V(3)A13 = \sum y$$

$$V(1)A21 + V(2)A22\ V(3)A23 = \sum xy$$

$$V(1)A31 + V(2)A32\ V(3)A33 = \sum x^2y$$

The ZX-81 cannot raise a negative number to a power j, so it is necessary to calculate ABS x^j and use subroutines 300 or 950 to determine the sign.

The normal equations are now in the form which is suitable for computer solution by the method of Gaussian elimination. In this method a multiplier, M_i, is defined. For the quadratic case already considered $M_2 = A21/A11$, such that when the first equation is multiplied by M_2 and subtracted from the second equation, V(1) is eliminated from equation 2.

The A(u,v) are then rescaled and a series of similar multipliers are then defined such that V(1) and V(2) are eliminated from the third equation, leaving it with one unknown V(3). The value of V(3) is therefore found. Back-substitution then leads naturally to V(2) and V(1), and thus the quadratic equation which is the best fit to the data has been obtained. This process is familiar to everyone who has suffered solving simultaneous equations at school and is easily extended to polynomials of any degree.

The conventional augmented matrix formulation of the Gaussian elimination procedure is used, subroutine 500, in which the Σx^iy terms, the G(1,J), are converted to the A(u, N + 2) terms in line 422. Before each elimination step the rows of the augmented matrix are reordered using subroutine 600. This procedure, often known as partial pivotal condensation, obviates the problems of dividing by zero when defining the multipliers should the A(u,v) term of the denominator be zero, and generally improves accuracy.

(continued on next page)

```
    5 REM "POLYFIT"
    6 REM POLYNOMIAL CURVE-FITTIN
G PROGRAMME
    7 REM BY A.D.WILSON
    8 REM  POLYNOMIAL HAS FORM
    SUM( V(I+1)*X**I )=F(Y)
    F(Y)=Y OR EXP Y OR LN Y
   10 PRINT "DISPLAY INTERMEDIATE
 CALULATION RESULTS?  PRESS Y"
   12 INPUT Y$
   14 CLS
   16 IF Y$="Y" THEN PRINT "   INT
ERMEDIATE CALCNS DISPLAYED"
   20 GOSUB 200
   25 GOSUB 230
   30 GOSUB 250
   40 IF Y$="Y" THEN GOSUB 320
   50 GOSUB 400
   60 IF Y$="Y" THEN GOSUB 450
   70 GOSUB 500
   80 GOSUB 700
   90 GOSUB 800
  100 GOSUB 900
  199 STOP
  200 REM DATA INPUT
  202 PRINT "NO OF DATA PAIRS,W"
  204 PRINT "W=";
  206 INPUT W
  208 PRINT W
  210 DIM X(W+1)
  212 DIM Y(W+1)
  214 PRINT " INPUT X,Y PAIRS"
  215 PRINT "X";TAB 10;"Y"
  216 FOR I=1 TO W
  218 INPUT X(I)
  220 INPUT Y(I)
  222 PRINT X(I);TAB 10;Y(I)
  224 NEXT I
  226 RETURN
  229 STOP
  230 REM EXP LOG DATA CONVERSION
  231 PRINT "CHOOSE FORM OF POLYN
OMIAL"
  232 PRINT "F(X)=Y          PRESS N
/L
                F(X)=LN Y     PRESS L
                F(X)=EXP Y    PRESS E
"
  234 INPUT L$
  235 IF L$<>"L" THEN GOTO 238
  236 PRINT "F(X)=LOG(Y)"
  237 GOTO 240
  238 IF L$<>"E" THEN GOTO 248
  239 PRINT "F(X)=EXP(Y)"
  240 FOR J=1 TO W
  241 IF L$="L" THEN LET Y(J)=LN
Y(J)
  242 IF L$="E" THEN LET Y(J)=EXP
Y(J)
  244 PRINT J;TAB 10;Y(J)
  246 NEXT J
  248 RETURN
  249 STOP
  250 REM SET-UP POLYNOMIAL NORMA
L EQUATIONS
  252 PRINT "DEGREE OF POLYN,N"
  254 PRINT "N=";
  255 INPUT N
  256 PRINT N
  258 IF N>W THEN GOTO 1000
  260 DIM F(2,2*N)
  262 DIM G(2,2*N)
  264 FOR J=1 TO 2*N
  266 LET F(1,J)=0
  268 LET G(1,J)=0
  270 NEXT J
```

(listing continued on next page)

(continued from prvious page)

The back-substitution process is given as subroutine 700. The subroutine at 800 prints out the regression coefficients and the subroutine at 900 prints out both the calculated values of y, for the x data point values, and the error between the calculated and experimental y values. The square of the error can be displayed by changing C1 to C2 in line 918.

The program was originally written to allow condensation of optical transmission data of glass filters in which transmittance, y, may vary by several orders of magnitude within a small range of wavelengths, x. It was found to be useful to be able to change the y data before curve fitting, for example by taking its natural logarithm. The subroutine at 230 allows the user to change the data from $Y = f(x)$ to either $\ln y = f(x)$ or rep $y = f(x)$.

The program has been used to fit several hundred sets of data. On only one occasion has a nonsensical result been obtained, and this was traced to extremely small values for some of the rescaled A(u,v). In such cases, line 10 allows all intermediate calculations, A(u,v) and M_i, to be displayed.

(listing continued from previous page)

```
 272 FOR I=1 TO W
 274 FOR J=1 TO 2*N
 276 GOSUB 300
 278 LET F(2,J)=(ABS X(I)**J)*J3
 280 LET F(1,J)=F(1,J)+F(2,J)
 282 NEXT J
 284 FOR J=0 TO N
 286 GOSUB 300
 288 LET G(2,J+1)=(ABS X(I)**J)*
Y(I)*J3
 290 LET G(1,J+1)=G(1,J+1)+G(2,J
+1)
 292 NEXT J
 294 NEXT I
 296 RETURN
 299 STOP
 300 REM ALLOWS NEGATIVE NO TO B
E RAISED TO POWER USING **
 302 LET J3=1
 304 LET J1=J/2
 306 LET J2=INT J1-J1
 308 IF SGN X(I)=-1 AND J2<>0 TH
EN LET J3=-1
 310 RETURN
 319 STOP
 320 REM PRINTS COEFS OF NORMAL
EQNS
 322 FOR J=1 TO 2*N
 324 PRINT F(1,J);TAB 14;G(1,J)
 326 NEXT J
 328 RETURN
 329 STOP
 400 REM TRANSFER OF F(1,J) COEF
S TO THE A(I,J) NEEDED FOR GAUSS
IAN ELIMINATION
 401 DIM A(N+2,N+2)
 402 LET I=1
 404 LET A(I,1)=W
 406 FOR J=2 TO N+1
 408 LET A(I,J)=F(1,I+J-2)
 410 NEXT J
 412 FOR I=2 TO N+1
 414 FOR J=1 TO N+1
 416 LET A(I,J)=F(1,I+J-2)
 418 NEXT J
 420 NEXT I
 422 FOR I=1 TO N+1
 424 LET A(I,N+2)=G(1,I)
 426 NEXT I
 428 RETURN
 449 STOP
 450 REM PRINTS A(I,J)
 452 FOR I=1 TO N+1
 454 FOR J=1 TO N+2
 456 PRINT "A(";I;J;")=";A(I,J)
 458 NEXT J
 460 NEXT I
 462 RETURN
 499 STOP
 500 REM GAUSSIAN ELIMINATION
 504 DIM V(N+2)
 506 GOSUB 400
 508 FOR K=1 TO N
 510 FOR I=K+1 TO N+1
 512 GOSUB 600
 514 LET M=A(I,K)/A(K,K)
 516 IF Y$="Y" THEN PRINT "M=";M
 518 LET A(I,K)=0
 520 FOR J=K+1 TO N+2
 522 LET A(I,J)=A(I,J)-M*A(K,J)
 524 IF Y$="Y" THEN PRINT "A(";I
;J;")=";A(I,J)
 526 NEXT J
 528 NEXT I
 530 NEXT K
 532 RETURN
 599 STOP
 600 REM ROW REORDERING
 602 LET L=K
 604 FOR H=I TO N+1
 606 IF ABS A(H,K)>ABS A(L,K) TH
EN GOTO 610
 608 GOTO 612
 610 LET L=H
 612 NEXT H
 614 IF L=K THEN GOTO 626
 616 FOR J=K TO N+2
 618 LET Q=A(K,J)
 620 LET A(K,J)=A(L,J)
 622 LET A(L,J)=Q
 624 NEXT J
 626 RETURN
 699 STOP
 700 REM BACK SUBSTITUTION
 702 LET V(N+1)=A(N+1,N+2)/A(N+1
,N+1)
 704 FOR I=N TO 1 STEP -1
 706 LET S=0
 708 FOR J=I+1 TO N+1
 710 LET S=S+A(I,J)*V(J)
 712 NEXT J
 714 LET V(I)=(A(I,N+2)-S)/A(I,I
)
 716 NEXT I
 718 RETURN
 800 REM PRINTS REGRESSION COEFS
,V(I)
 801 PRINT "REGRESSION COEFS,V(I
)"
 802 PRINT "POLY=V(N+1)*X**N....
V(2)*X +V(1)"
 803 PRINT
 804 FOR I=1 TO N+1
 806 PRINT "V(";I;")=";V(I)
 808 PRINT
 810 NEXT I
 812 RETURN
 899 STOP
 900 REM CHECK ON ACCURACY
 901 PRINT "PT";TAB 3;"CALCD";TA
B 17;"ERROR"
 902 FOR J=1 TO W
 904 LET C=0
 905 GOSUB 950
 906 FOR I=1 TO N+1
 908 LET C=C+V(I)*(ABS X(J)**(I-
1)*J3)
 910 NEXT I
 914 LET C1=C-Y(J)
 916 LET C2=C1*C1
 918 PRINT J;TAB 3;C;TAB 17;C1
 920 NEXT J
 922 RETURN
 949 STOP
 950 REM ALLOWS NEGATIVE NO TO B
E RAISED TO POWER USING **
 952 LET J3=1
 954 LET J1=(I-1)/2
 956 LET J2=INT J1-J1
 958 IF SGN X(J)=-1 AND J2<>0 TH
EN LET J3=-1
 960 RETURN
 999 STOP
1000 PRINT "FEWER DATA PAIRS(W="
;W;") THAN       REQUIRED FOR SOL
UTION OF        POLYNOMIAL(N=";N
;")"
1001 PRINT
1002 PRINT
1003 PRINT
1004 PRINT "RE-RUN"
```

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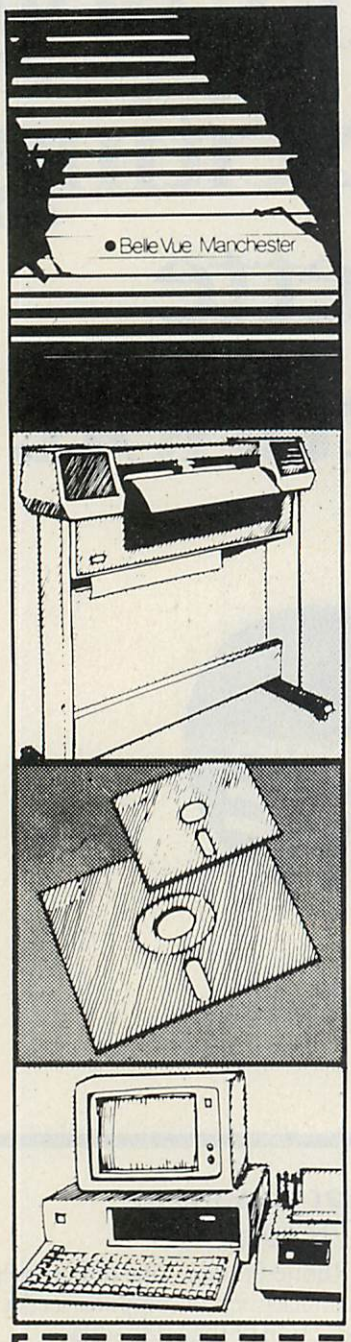

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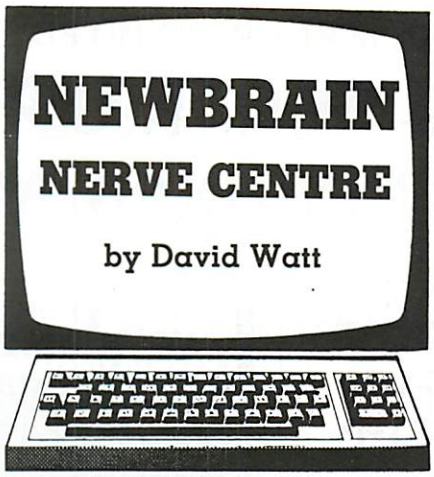


Letter writer

BY TYPING you letters as a program consisting of Rem statements you can make use of the Newbrain's text-editing capabilities to print nicely formatted letters, using this program by Robert Lewsley. After saving the program on tape, the program will read the saved program, stripping off the line number and Rem token, and print the remaining part of the lines.

RT$ is set to the value of the Rem token, 142, at line 2390, and the token is tested for at line 2580. If words do not fit on a line they are printed on the next, and the program inserts spaces in the line to justify the right margin.

Again the program is designed to use the Oki 82a. Lines 2490 and 2500 set the characteristics of the printer. For the Epson MX-80 Mk III these lines should be changed to:

2490 PUT £8,18,27,81,64
2500 IF ch$ = "s" OR ch$ = "S" THEN PUT £8,15,27,81,80

Perhaps someone may care to contribute a text-editing program to get round the inconvenience of having to type line numbers and Rem statements when entering your letter.

Monitor

Steve Parker of Morecambe, Lancashire, points out that there is no easy way of inputting machine code to the Newbrain, and has sent in a program to fill the gap. Besides allowing you to examine or amend memory, blocks of memory can be stored on tape or updated from tape.

The program displays the current address and byte, in hexadecimal format. You can change the contents of the current address by just entering the new value, or you can select one of the following commands:

↑—view the previous byte
↓—view the next byte
Ctrl-A — change the current address
Ctrl-C — create a file descriptor
Ctrl-O — output file
Ctrl-F — find and read file descriptor
Ctrl-1 — read file

Two Newbrain files are created for each

(continued on page 188)

Letter writer.

```
2000 REM "letter.writer"
2010 REM program allow use of Newbrain
2020 REM and Oki 82a as a typewriter.
2030
2040 REM Text is written as a program
2050 REM containing nothing but rems
2060 REM then saved to tape as normal.
2070
2080 REM This program then reads program
2090 REM tape, stripping line numbers
2100 REM and rem tokens before printing
2110 REM with some simple formatting.
2120
2130
2140 OPEN£0,0,"124"
2150 PUT 31
2160 PRINT TAB(30);"LETTER PRINTER";TAB(
     65);"(c) R. Lewsley"
2170 PRINT TAB(30);"■■■■■■■■■■■■■■■"
2180 PUT 10,10
2190 LINPUT ("Enter desired line width (
     max. 64 at 10cpi or 80 at 16.5 cpi)
     : ") m$
2200 IF NUM(m$) THEN 2220
2210 PUT10:PRINT "Bad value - try again"
     :PUT 10:GOTO 2190
2220 m=VAL(m$):IF m)80 OR m(1 THEN 2210
2230
2240 PUT 10:LINPUT ("Enter L for 10 cpi
     or S for 16.5 cpi : ") ch$
2250 IF ch$="1" OR ch$="L" OR ch$="s" OR
      ch$="S" THEN 2270
2260 PUT 10:PRINT "Bad value - try again
     ":GOTO 2240
2270 IF (ch$="1" OR ch$="L") AND m)64 TH
     EN PUT 10:PRINT "Bad line length/ch
     aracter size combination":GOTO 2190
2280
2290 PUT 10:LINPUT ("Is printer at top o
     f form? y/n : ") yn$
2300 IF yn$="y" OR yn$="Y" THEN lc=1:GOT
     O 2340
2310 IF yn$="n" OR yn$="N" THEN lc=99:GO
     TO 2340
2320 PUT 10:PRINT "Invalid response - tr
     y again":GOTO 2290
2330
2340 PUT 10:LINPUT ("Enter name of file
     to be printed : ") f$
2350
2360 REM - conversational bits over
2370
2380 PUT 31:PRINT "Load tape 1 with inpu
     t file and press play."
2390 rt$=CHR$(142)
2400 CLOSE£8:OPEN£8,8,"1200"
2410 CLOSE£1:OPEN£1,1,f$
2420
2430 PUT 31:PRINT "Trying print access n
     ow":PRINT£8," ":PUT 31
2440
2450 PRINT "W O R K I N G"
2460
2470 x$=" "
2480 REM - set default to 10 cpi  short
     line then alter if required
2490 PUT£8,30,27,66
2500 IF ch$="s" OR ch$="S" THEN PUT£8,29
     ,27,66
2510 REM - 29,27,66 = 16.5 cpi,short lin
     e of 106 chars on OKI 82a
2520 REM   but max allowed by NEWBRAIN
     is 80 (unless comms port is used)
2530 LINPUT£1,a$
2540 l=LEN(a$)
2550 IF a$=CHR$(4) THEN CLOSE£1:PUT 31:P
     RINT "READY":END
2560 IF LEN(a$)=0 THEN 2530
2570 FOR i=1 TO l:REM search for rem
2580 IF MID$(a$,i,1) = rt$ THEN 2600
2590 NEXT i
2600 i=l-(i+1)
2610 IF i(1 THEN a$=" ":GOTO 2640
2620 a$=RIGHT$(a$,i):REM strip off line
     number and rem token
2630
2640 x$=a$
2650 l=LEN(a$)
2660
2670 REM check if small enough for immed
     iate printing
2680 REM       if yes then check if page
      full and print
2690
2700 IF l)m THEN 2790
2710 lc=lc+1
2720 IF lc)50 THEN lc=1:PUT£8,12
2730 PRINT£8,x$
2740 GOTO 2530
2750
2760 REM chop back to previous space
2770
2780
2790 i=m+1
2800 i=i-1
2810 IF i=1 THEN i=m:GOTO 2850
2820 c$=MID$(x$,i,1)
2830 IF c$() " " THEN 2800
2840
2850 x$=LEFT$(a$,i)
2860 a$=RIGHT$(a$,(l-i))
2870 lc=lc+1
2880 IF lc)50 THEN lc=1:PUT£8,12
2890
2900 REM - distribute blanks into line
     trying to tidy the right margin
2910
2920 p=LEN(x$)
2930 q=m-p:IF q ( 1 THEN PRINT£8,x$:GOTO
      2640
2940 b=0:bt=0:bi=0
2950 FOR i=1 TO p
2960 IF MID$(x$,i,1) = " " THEN b=b+1
2970 NEXT i
2980 bs=INT(b/q + .5)
2990 y$=" ":CLEAR y$
3000 FOR i=1 TO p
3010 c$=MID$(x$,i,1)
3020 y$=y$+c$
3030 IF c$()" " THEN 3070
3040 bt=bt+1
3050 IF bt(bs THEN 3070
3060 y$=y$+c$:bt=0:bi=bi+1:IF bi)=q THEN
      bs=99
3070 NEXT i
3080 PRINT£8,y$
3090 GOTO 2640
```

Monitor.

```
101     REM Machine code monitor/tape
    file system
102     REM by Steve Parker.
103     REM for Newbury Newbrain
104     REM
5600    h$=bi$: GOSUB 30000: IF e THEN
    15000: REM e=error flag for dec to
    hex & hex to dec conversion.
9980    REM set up I/O streams &
    variables etc.
9999    REM
10000   ON BREAK GOTO 60000: ON ERROR
    GOTO 60010
10100   FOR i=1 TO 255: CLOSE £i: NEXT i
    : kb=12: OPEN £kb,6: vf=2: OPEN £vf
    ,3:  sn=0: OPEN £sn,0,"20": PUT £vf
    ,6: tp=50: FOR i=1 TO 11: nl$=nl$+C
    HR$(0):NEXT i: bl$=CHR$(28)
10101   REM AD uses vf display: for A
    use:- open £vf,0,2,"s1"
10102   REM to open up a single line
    display on stream 2.
14997   REM


14998   REM main loop.
14999   REM
15000   ct=0: bi$="": PUT £vf,2
15100   GOSUB 37000: REM ? current byte
15200   cf=0: GOSUB 35000: IF cf THEN
    GOSUB 41000: GOTO 15000
15400   PUT £vf,a: bi$=bi$+a$: ct=ct+1:
    IF ct<2 THEN 15200
15600   h$=bi$: GOSUB 30000: IF e THEN
    15000: REM e=error flag for dec to
    hex & hex to dec conversion.
15700   POKE ad,dc: ad=ad+1: GOTO 15000


15701   REM
15702   REM end of main loop
15703   REM
29988   REM hex to dec conversion
29999   REM
30000   hx$="0123456789abcdef": e=0: dc=
    0: pp=LEN(h$): cp=-1
30100   IF pp=0 THEN RETURN
30200   v=INSTR(hx$,MID$(h$,pp,1))-1: IF
    v<0 THEN e=-1: RETURN: REM error t
    rap
30300   pp=pp-1: cp=cp+1: dc=dc+v*16↑cp:
    GOTO 30100
30301   REM
30302   REM sub end
30303   REM
30998   REM dec to hex
30999   REM
31000   hx$="0123456789abcdef"
31100   n1=4096: n2=256: n3=16: c1=INT(
    dc/n1): dc=dc-n1*c1: c2=INT(dc/n2):
     dc=dc-c2*n2: c3=INT(dc/n3): c4=dc-
    c3*n3:  h$=MID$(hx$,c1+1,1) + MID$(
    hx$,c2+1,1) + MID$(hx$,c3+1,1) + MI
    D$(hx$,c4+1,1): h$=RIGHT$(h$,i): RE
    M i= no of bytes in string to be re
    tained
```

(listing continued on page 188)

(listing continued from page 185)

```
31200   e=c1<0 OR c2<0 OR c3<0 OR c4<0
    OR c1>15 OR c2>15 OR c3>15 OR c4>15
     :  RETURN : REM set error flag as
    required
31201   REM
31202   REM sub end
34997   REM


34998   REM get key
34999   REM
35000   GET £kb,a$: a=ASC(a$): IF a=0
    THEN 35000
35050   IF a>31 THEN RETURN
35100   cf=(a=1) + (a=10) + (a=11) + (a=
    9) + (a=15) + (a=3) + (a=6): RETURN
35101   REM
35102   REM subend
35103   REM


35998   REM get new address
35999   REM
36000   ad$="": PUT £vf,b1$
36100   GOSUB 35000: PUT £vf,a: ad$=ad$+
    a$: IF LEN(ad$)<4 THEN 36100
36200   h$=ad$: i=2: GOSUB 30000: IF e
    THEN 36000
36250   ad=dc: RETURN
36251   REM
36252   REM sub end
36253   REM
36997   REM print out current address
    and byte
36999   REM
37000   dc=ad: i=4: GOSUB 31000: ad$=h$:
     dc=PEEK(ad): c=1: i=2: GOSUB 31000
    :  ? £vf,b1$;ad$;" ";h$;:PUT £vf,8,
    8:RETURN
37001   REM
37002   REM sub end
37003   REM


40997   REM select routine for control c
    odes
40999   REM
41000   sw=ABS((a=1)*1+(a=10)*2+(a=6)*3+
    (a=9)*4+(a=3)*5+(a=15)*6+(a=11)*7)
41010   IF sw>0 AND sw<8 THEN ON sw
    GOSUB 36000,42000,62000,62300,63000
    ,  63300,43000
41020   RETURN
41101   REM
41102   REM sub end
41103   REM
41998   REM view next byte
41999   REM
42000   ad=ad+1: RETURN
42001   REM
42002   REM sub end
42003   REM


42998   REM view previous byte
42999   REM
43000   IF ad>0 THEN ad=ad-1
43010   RETURN
43101   REM
43102   REM sub end
43103   REM
51998   REM find tape file
51999   REM


59998   REM error handler
59999   REM
60000   END
60010   IF ERRLIN=62000 THEN RESUME
60020   IF ERRLIN=63100 THEN RESUME
    63000
60030   GOTO 60000
60031   REM


60032   REM error check end
60033   REM
62000   ? £sn,"find file": ? £sn,"enter
    file name": INPUT £sn,t$:  t$=LEFT$
    (t$+nl$,11)
62100   OPEN IN£tp,1,"*1": GET £tp,a$:
    IF a$="*" THEN CLOSE £tp: GOTO 6210
    0
62120   tt$=a$:FOR i=2 TO 11:GET £tp,a$:
    tt$=tt$+a$: NEXT i:GET £tp,sh,sl,fh
    ,fl:CLOSE £tp: ? £sn,"found ";tt$;"
    ":: sa=sh*256+sl: fa=fh*256+fl: dc
    =sa: GOSUB  31000: ? £sn,h$: IF tt$
    <>t$ THEN 62100
62150   RETURN
62151   REM
62152   REM sub end
62153   REM
62298   REM read file
62300   ? £sn,"loading":   OPEN IN£tp,1,
    "*1": GET £tp,a: FOR i=sa TO fa:GET
    £tp,a: POKE i,a: NEXT i: CLOSE £tp
    : ? £sn,"completed": RETURN
62301   REM
62302   REM sub end
62303   REM
62998   REM create file
62999   REM
63000   ? £sn,"create file": ?£sn,"enter
    file name, start & end address"
63100   INPUT £sn,t$,sa$,fa$:i=2:h$=sa$:
    GOSUB 30000:e1=e:sa=dc:sh=INT(sa/25
    6): sl=sa-sh*256: h$=fa$: GOSUB 300
    00: fa=dc:fh=INT(fa/256) :fl=fa-fh*
    256: IF e OR e1 OR LEN(sa$)<>4 OR L
    EN(fa$)<>4 OR sa>=fa THEN PUT £sn,1
    1,2: GOTO 63100
63200   ? £sn,"outputting file header":
    OPEN OUT£tp,1,"*1": FOR i=1 TO 11:
    PUT £tp,MID$(t$,i,1): NEXT i: PUT £
    tp,sh,sl,fh,fl: CLOSE £tp:  ? £sn,"
    completed": RETURN
63201   REM
63202   REM sub end
63203   REM


63298   REM output file
63299   REM
63300   ? £sn,"outputting file": OPEN
    OUT£tp,1,"*1": PUT £tp,42: FOR i=sa
     TO fa: PUT £tp,PEEK(i): NEXT i: CL
    OSE £tp:?£sn,"completed": RETURN
63301   REM
63302   REM sub end
63303   REM
```

(continued from page 185)

Monitor file. The Descriptor file contains the file name and start and addresses and the second file the actual machine code. The descriptor files are all the same length because the file name is truncated or padded out to 11 characters. You can change the descriptor file without overwriting the following file.

When using the program, reserve an area of memory for your machine-code routine before entering your code, otherwise Basic may overwrite it. Remove the Rems to reduce the size of the program if you need more space to code in; Mr Parker claims the program will run in a little less than 16K with the Rems removed. You might find it useful to leave out the Error and Break traps until you are satisfied the program is running correctly.

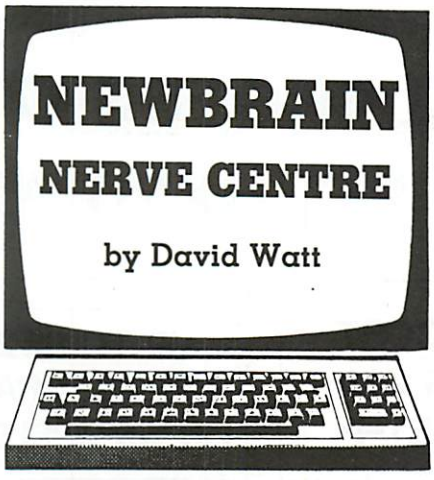
Hangman

For those readers with small children, John Braga of Huntingdon has provided a version of the well-known game Hangman. The words to be used by the program should be typed into lines 1000 to 1099. Line 1099 itself should be left unchanged as the * acts as an End of Data signal. You can choose the words with the age of the child in mind.

Having two small children myself, I know how keen they are to press the buttons. My 3½-year-old daughter was more interested in seeing the little man get drawn than in guessing the word, but either way she had a great deal of fun playing the game.

Hangman.

```
1 REM  HANGMAN PROGRAM FOR NEWBRAIN
2 REM
3 REM (C) JOHN BRAGA 1982
4 REM
5 REM
10 OPEN £0,0,"1200"
20 CLOSE £1 : OPEN £1,11, "160" : REM OP
    EN GRAPHICS STREAM
25 CLOSE £2 : OPEN  £2,5 : REM OPEN KEYB
    OARD FOR SINGLE CHARACTER ENTRY
30 PLOT BCK(1),WIPE,RANGE(24,10): GO=0 :
     WR=0 : REM CLEAR COUNTERS AND SCRE
    EN
40 AL(1)=1 : CLEAR AL() : Y$="" : REM CL
    EAR ARRAY
45 PLOT PLA(7,9),MODE(0), "H A N G M A N
    !"
50 PUT 31 : REM CLEAR TEXT SCREEN
60 READ X$ : IF LEN(X$)>10 THEN 60
65 IF X$="*" THEN CLOSE £1 : CLOSE £2 :
    OPEN £0,0 :PRINT "End of Executions
    !" :  END
70 FOR Z=1 TO LEN(X$)
80 PLOT MODE(1),PLA(Z*1.5+7,5)," " : R
    EM DRAW BLANKS
90 NEXT Z
100 PUT 12: PRINT "Guess a letter! "
110 GET £2,Z : REM GET CHARACTER
120 IF Z<97 OR Z>122 THEN 110 : REM LOOP
     IF NOT ALLOWED
130 PUT Z : REM PRINT IF  OK
140 Z$=CHR$(Z)
145 F=0 : REM FOUND FLAG
150 FOR Y=1 TO LEN(X$)
152 IF MID$(X$,Y,1)=Z$ THEN IF AL(Y)=0 T
    HEN AL(Y)=1 : F=1 : GO=GO+1 : PLOT
    PLA(1.5*Y+7,5+,MODE(2)," "&Z$&" "
154 NEXT Y
156 IF F=0 THEN 300 : REM GOTO 300 IF NO
    T FOUND
160 IF GO<LEN(X$) THEN 100 : REM LOOP BA
    CK IF MORE TO GO
170 PUT 31 : REM CLEAR
180 PRINT "Hurrah!   You have been repri
    eved!"
190 PRINT "Press any key";  : GET £2,Z
200 GOTO 30
300 REM WRONG GUESS!
305 Y$=Y$&Z$ : PUT 22,1,5 : PRINT "Wrong
    - "; Y$
310 WR=WR+1
320 ON WR GOSUB 360,370,380,390,410,420,
    460,480,490,510,560,610,660
325 IF WR=13 THEN 700
330 GOTO 100
350 REM 360-380 DRAW THE SCAFFOLD!
360 PLOT PLA(1,2),DRAW(.5,1,1),DRAW(1.5,
    1,1):RETURN:REM BASE
370 PLOT PLA(1,2),MVE(1,9):RETURN:REM PO
    LE
380 PLOT PLOT PLA(1,9),MVE(3.5,9),PLA(1,
    8),MVE(2,9):RETURN: REM BAR
390 PLOT PLA(3,9),MVE(3,8) :RETURN : REM
     ROPE
400 REM DRAW HEAD
410 PLOT PLA(3,8),DEGREES,TURN(180),ARC(
    PI,360) : RETURN
420 PLOT PLA(3,7.8),FIL : RETURN
450 REM DRAW NECK
460 PLOT PLA(2.9,8),MVE(2.9,6.7),MVE(3.1
    ,6.7),MVE(3.1,8),PLA(3,7),FIL :RETU
    RN
470 REM DRAW BODY
480 PLOT PLA(3,6.7),TURN(180),ARC(2*PI,3
    60):RETURN
490 PLOT PLA(3,6.7),FIL : RETURN
500 REM LEFT ARM
510 PLOT PLA(3,6),MVE(1.6,6),DRW(1.4,6.1
    ,1),DRW(1.4,6,1),DRW(1.4,5.9,1),
            DRW(1.4,5.8,1),DRW(1.4,5.7,
    1)
520 RETURN
550 REM RIGHT ARM
560 PLOT PLA(3,6),MVE(4.3,6),DRW(4.5,6.1
    ),DRW(4.5,6,1),DRW(4.5,5.9,1),
            DRW(4.5,5.7,1)
570 RETURN
600 REM LEFT LEG
610 PLOT PLA(2.5,5,MVE(2,3.4),MVE(2,1.8)
    ,MVE(1.8,2),PLA(2.8,5),
            MVE(2.3,3.4),MVE(2.1,1.8),M
    VE(1.8,2),PLA(2.2,3.4),FIL
640 RETURN
650 REM RIGHT LEG
660 PLOT PLA(3.5,5),MVE(4,3.4),MVE(4,1.8
    ),MVE(4.2,2),PLA(3.2,5),
            MVE(3.8,3.4),MVE(3.9,1.8),M
    VE(4.2,2),PLA(3.9,3.4),FIL
690 RETURN
700 PUT 31
710 PRINT "You are hanged!"
720 PRINT "The word was ";X$
730 PRINT "Press any key ":: GET J2,Z
740 GOTO 30
1000 DATA TEST,EXAMPLE,PUT,ANY,WORD,HERE
    ,
1005 DATA OR,HERE,ETCETERA
1099 DATA * : REM LEAVE THIS AS END-OF-D
    ATA SIGNAL
```



Letter writer

BY TYPING you letters as a program consisting of Rem statements you can make use of the Newbrain's text-editing capabilities to print nicely formatted letters, using this program by Robert Lewsley. After saving the program on tape, the program will read the saved program, stripping off the line number and Rem token, and print the remaining part of the lines.

RT$ is set to the value of the Rem token, 142, at line 2390, and the token is tested for at line 2580. If words do not fit on a line they are printed on the next, and the program inserts spaces in the line to justify the right margin.

Again the program is designed to use the Oki 82a. Lines 2490 and 2500 set the characteristics of the printer. For the Epson MX-80 Mk III these lines should be changed to:

2490 PUT £8,18,27,81,64
2500 IF ch$ = "s" OR ch$ = "S" THEN PUT £8,15,27,81,80

Perhaps someone may care to contribute a text-editing program to get round the inconvenience of having to type line numbers and Rem statements when entering your letter.

Monitor

Steve Parker of Morecambe, Lancashire, points out that there is no easy way of inputting machine code to the Newbrain, and has sent in a program to fill the gap. Besides allowing you to examine or amend memory, blocks of memory can be stored on tape or updated from tape.

The program displays the current address and byte, in hexadecimal format. You can change the contents of the current address by just entering the new value, or you can select one of the following commands:

↑—view the previous byte
↓—view the next byte
Ctrl-A — change the current address
Ctrl-C — create a file descriptor
Ctrl-O — output file
Ctrl-F — find and read file descriptor
Ctrl-1 — read file

Two Newbrain files are created for each

(continued on page 188)

Letter writer.

```
2000 REM "letter.writer"
2010 REM program allow use of Newbrain
2020 REM and Oki 82a as a typewriter.
2030
2040 REM Text is written as a program
2050 REM containing nothing but rems
2060 REM then saved to tape as normal.
2070
2080 REM This program then reads program
2090 REM tape, stripping line numbers
2100 REM and rem tokens before printing
2110 REM with some simple formatting.
2120
2130
2140 OPEN£0,0,"124"
2150 PUT 31
2160 PRINT TAB(30);"LETTER PRINTER";TAB(
     65);"(c) R. Lewsley"
2170 PRINT TAB(30);"**************"
2180 PUT 10,10
2190 LINPUT ("Enter desired line width (
     max. 64 at 10cpi or 80 at 16.5 cpi)
      : ") m$
2200 IF NUM(m$) THEN 2220
2210 PUT10:PRINT "Bad value - try again"
     :PUT 10:GOTO 2190
2220 m=VAL(m$):IF m)80 OR m(1 THEN 2210
2230
2240 PUT 10:LINPUT ("Enter L for 10 cpi
     or S for 16.5 cpi : ") ch$
2250 IF ch$="l" OR ch$="L" OR ch$="s" OR
      ch$="S" THEN 2270
2260 PUT 10:PRINT "Bad value - try again
     ":GOTO 2240
2270 IF (ch$="l" OR ch$="L") AND m)64 TH
     EN PUT 10:PRINT "Bad line length/ch
     aracter size combination":GOTO 2190

2280
2290 PUT 10:LINPUT ("Is printer at top o
     f form? y/n : ") yn$
2300 IF yn$="y" OR yn$="Y" THEN lc=1:GOT
     O 2340
2310 IF yn$="n" OR yn$="N" THEN lc=99:GO
     TO 2340
2320 PUT 10:PRINT "Invalid response - tr
     y again":GOTO 2290
2330
2340 PUT 10:LINPUT ("Enter name of file
     to be printed : ") f$
2350
2360 REM - conversational bits over
2370
2380 PUT 31:PRINT "Load tape 1 with inpu
     t file and press play."
2390 rt$=CHR$(142)
2400 CLOSE£8:OPEN£8,8,"1200"
2410 CLOSE£1:OPEN£1,1,f$
2420
2430 PUT 31:PRINT "Trying print access n
     ow":PRINT£8," ":PUT 31
2440
2450 PRINT "W O R K I N G"
2460
2470 x$=" "
2480 REM - set default to 10 cpi  short
     line then alter if required
2490 PUT£8,30,27,66
2500 IF ch$="s" OR ch$="S" THEN PUT£8,29
     ,27,66
2510 REM - 29,27,66 = 16.5 cpi,short lin
     e of 106 chars on OKI 82a
2520 REM    but max allowed by NEWBRAIN
     is 80 (unless comms port is used)
2530 LINPUT£1,a$
2540 l=LEN(a$)
2550 IF a$=CHR$(4) THEN CLOSE£1:PUT 31:P
     RINT "READY":END
2560 IF LEN(a$)=0 THEN 2530
2570 FOR i=1 TO l:REM search for rem
2580 IF MID$(a$,i,1) = rt$ THEN 2600
2590 NEXT i
2600 i=l-(i+1)
2610 IF i(1 THEN a$=" ":GOTO 2640
2620 a$=RIGHT$(a$,i):REM strip off line
     number and rem token
2630
2640 x$=a$
2650 l=LEN(a$)
2660
2670 REM check if small enough for immed
     iate printing
2680 REM       if yes then check if page
      full and print
2690
2700 IF l)m THEN 2790
2710 lc=lc+1
2720 IF lc)50 THEN lc=1:PUT£8,12
2730 PRINT£8,x$
2740 GOTO 2530
2750
2760 REM chop back to previous space
2770
2780
2790 i=m+1
2800 i=i-1
2810 IF i=1 THEN i=m:GOTO 2850
2820 c$=MID$(x$,i,1)
2830 IF c$() " " THEN 2800
2840
2850 x$=LEFT$(a$,i)
2860 a$=RIGHT$(a$,(l-i))
2870 lc=lc+1
2880 IF lc)50 THEN lc=1:PUT£8,12
2890
2900 REM - distribute blanks into line
     trying to tidy the right margin
2910
2920 p=LEN(x$)
2930 q=m-p:IF q ( 1 THEN PRINT£8,x$:GOTO
      2640
2940 b=0:bt=0:bi=0
2950 FOR i=1 TO p
2960 IF MID$(x$,i,1) = " " THEN b=b+1
2970 NEXT i
2980 bs=INT(b/q + .5)
2990 y$=" ":CLEAR y$
3000 FOR i=1 TO p
3010 c$=MID$(x$,i,1)
3020 y$=y$+c$
3030 IF c$()" " THEN 3070
3040 bt=bt+1
3050 IF bt(bs THEN 3070
3060 y$=y$+c$:bt=0:bi=bi+1:IF bi)=q THEN
      bs=99
3070 NEXT i
3080 PRINT£8,y$
3090 GOTO 2640
```

Monitor.

```
101     REM Machine code monitor/tape
     file system
102     REM by Steve Parker.
103     REM for Newbury Newbrain
104     REM
5600    h$=bi$: GOSUB 30000: IF e THEN
     15000: REM e=error flag for dec to
     hex & hex to dec conversion.
9980    REM set up I/O streams &
     variables etc.
9999    REM
10000   ON BREAK GOTO 60000: ON ERROR
     GOTO 60010
10100   FOR i=1 TO 255: CLOSE £i: NEXT i
     : kb=12: OPEN £kb,6: vf=2: OPEN £vf
     ,3:  sn=0: OPEN £sn,0,"20": PUT £vf
     ,6: tp=50: FOR i=1 TO 11: nl$=nl$+C
     HR$(0):NEXT i: bl$=CHR$(28)
10101   REM AD uses vf display: for A
     use:- open £vf,0,2,"s1"
10102   REM to open up a single line
     display on stream 2.
14997   REM


14998   REM main loop.
14999   REM
15000   ct=0: bi$="": PUT £vf,2
15100   GOSUB 37000: REM ? current byte
15200   cf=0: GOSUB 35000: IF cf THEN
     GOSUB 41000: GOTO 15000
15400   PUT £vf,a: bi$=bi$+a$: ct=ct+1:
     IF ct<2 THEN 15200
15600   h$=bi$: GOSUB 30000: IF e THEN
     15000: REM e=error flag for dec to
     hex & hex to dec conversion.
15700   POKE ad,dc: ad=ad+1: GOTO 15000


15701   REM
15702   REM end of main loop
15703   REM
29988   REM hex to dec conversion
29999   REM
30000   hx$="0123456789abcdef": e=0: dc=
     0: pp=LEN(h$): cp=-1
30100   IF pp=0 THEN RETURN
30200   v=INSTR(hx$,MID$(h$,pp,1))-1: IF
     v<0 THEN e=-1: RETURN: REM error t
     rap
30300   pp=pp-1: cp=cp+1: dc=dc+v*16↑cp:
     GOTO 30100
30301   REM
30302   REM sub end
30303   REM
30998   REM dec to hex
30999   REM
31000   hx$="0123456789abcdef"
31100   n1=4096: n2=256: n3=16: c1=INT(
     dc/n1): dc=dc-n1*c1: c2=INT(dc/n2):
      dc=dc-c2*n2: c3=INT(dc/n3): c4=dc-
     c3*n3:  h$=MID$(hx$,c1+1,1) + MID$(
     hx$,c2+1,1) + MID$(hx$,c3+1,1) + MI
     D$(hx$,c4+1,1): h$=RIGHT$(h$,i): RE
     M i= no of bytes in string to be re
     tained
```

(listing continued on page 188)

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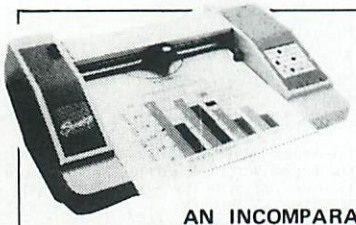

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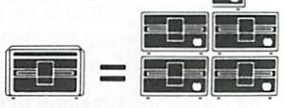

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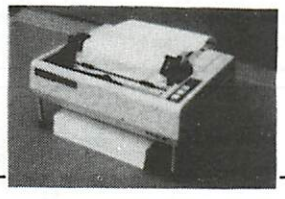

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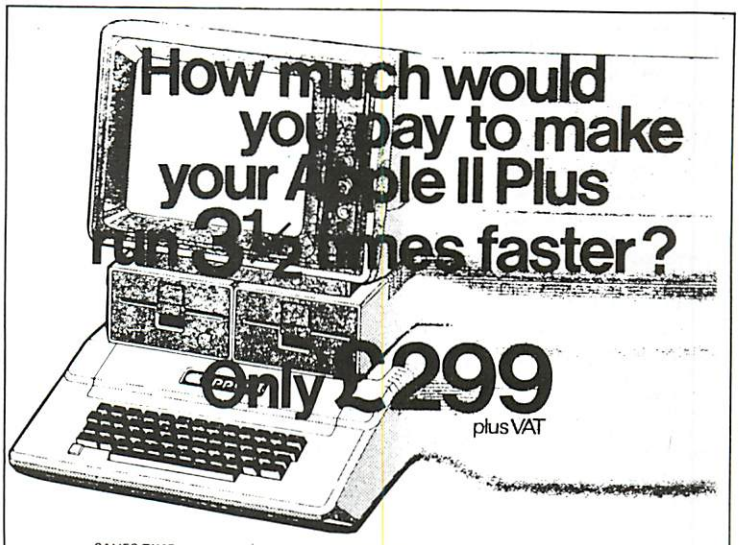

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In November 1982, PCW published a bumper round up of all the Benchmark Timings since PCW began. The Olivetti M20 came out top of the 'league' with an average Benchmark timing of 11.5. Running the same Benchmark test programs, the Apple II Plus with Accelerator II averages a timing of 8.58 — that's an incredible 25% faster than the Olivetti M20.

We have reproduced some of PCW's findings, incorporating Benchmark Timings for the Apple II Plus with Accelerator II.

Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
Apple II Plus with Accelerator II	0.3	2.4	4.5	5.0	5.5	8.2	12.9	2.98	8.6
Olivetti M20	1.3	4.0	8.1	8.5	9.6	17.4	26.7	1.6	11.5
IBM Personal Computer	1.5	5.2	12.1	12.6	13.6	23.5	37.4	3.5	17.6
Osborne 01	1.4	4.4	11.7	11.6	12.3	21.9	34.9	6.1	19.9
Intertec Superbrain	1.6	5.2	14.0	13.9	14.8	26.3	43.2	5.6	21.9
Apple III	1.7	7.2	13.5	14.5	16.0	27.0	42.5	7.5	24.7
ACT Sirius 1	2.0	7.4	17.0	17.5	19.8	35.4	55.9	4.3	24.8
Xerox 820	1.7	5.5	15.5	15.1	16.2	28.9	46.1	8.0	26.1
Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	10.7	30.4
Commodore CBM 8032	1.7	10.0	18.4	20.3	21.9	32.4	51.0	11.9	34.3

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(listing continued from page 185)

```
31200   e=c1<0 OR c2<0 OR c3<0 OR c4<0
    OR c1>15 OR c2>15 OR c3>15 OR c4>15
    : RETURN : REM set error flag as
    required
31201   REM
31202   REM sub end
34997   REM


34998   REM get key
34999   REM
35000   GET £kb,a$: a=ASC(a$): IF a=0
    THEN 35000
35050   IF a>31 THEN RETURN
35100   cf=(a=1) + (a=10) + (a=11) + (a=
    9) + (a=15) + (a=3) + (a=6): RETURN
35101   REM
35102   REM subend
35103   REM


35998   REM get new address
35999   REM
36000   ad$="": PUT £vf,b1$
36100   GOSUB 35000: PUT £vf,a: ad$=ad$+
    a$: IF LEN(ad$)<4 THEN 36100
36200   h$=ad$: i=2: GOSUB 30000: IF e
    THEN 36000
36250   ad=dc: RETURN
36251   REM
36252   REM sub end
36253   REM
36997   REM print out current address
    and byte
36999   REM
37000   dc=ad: i=4: GOSUB 31000: ad$=h$:
    dc=PEEK(ad): c=1: i=2: GOSUB 31000
    : ? £vf,b1$;ad$;" ";h$;:PUT £vf,8,
    8:RETURN
37001   REM
37002   REM sub end
37003   REM


40997   REM select routine for control c
    odes
40999   REM
41000   sw=ABS((a=1)*1+(a=10)*2+(a=6)*3+
    (a=9)*4+(a=3)*5+(a=15)*6+(a=11)*7)
41010   IF sw>0 AND sw<8 THEN ON sw
    GOSUB 36000,42000,62000,62300,63000
    , 63300,43000
41020   RETURN
41101   REM
41102   REM sub end
41103   REM
41998   REM view next byte
41999   REM
42000   ad=ad+1: RETURN
42001   REM
42002   REM sub end
42003   REM


42998   REM view previous byte
42999   REM
43000   IF ad>0 THEN ad=ad-1
43010   RETURN
43101   REM
43102   REM sub end
43103   REM
51998   REM find tape file
51999   REM


59998   REM error handler
59999   REM
60000   END
60010   IF ERRLIN=62000 THEN RESUME
60020   IF ERRLIN=63100 THEN RESUME
    63000
60030   GOTO 60000
60031   REM


60032   REM error check end
60033   REM
62000   ? £sn,"find file": ? £sn,"enter
    file name": INPUT £sn,t$:  t$=LEFT$
    (t$+n1$,11)
62100   OPEN IN£tp,1,"*1": GET £tp,a$:
    IF a$="*" THEN CLOSE £tp: GOTO 6210
    0
62120   tt$=a$:FOR i=2 TO 11:GET £tp,a$:
    tt$=tt$+a$: NEXT i:GET £tp,sh,sl,fh
    ,fl:CLOSE £tp: ? £sn,"found ";tt$;"
    ":: sa=sh*256+sl: fa=fh*256+fl: dc
    =sa: GOSUB  31000: ? £sn,h$: IF tt$
    <>t$ THEN 62100
62150   RETURN
62151   REM
62152   REM sub end
62153   REM
62298   REM read file
62300   ? £sn,"loading":   OPEN IN£tp,1,
    "*1": GET £tp,a: FOR i=sa TO fa:GET
    £tp,a: POKE i,a: NEXT i: CLOSE £tp
    : ? £sn,"completed": RETURN
62301   REM
62302   REM sub end
62303   REM
62998   REM create file
62999   REM
63000   ? £sn,"create file": ?£sn,"enter
    file name, start & end address"
63100   INPUT £sn,t$,sa$,fa$:i=2:h$=sa$:
    GOSUB 30000:e1=e:sa=dc:sh=INT(sa/25
    6): sl=sa-sh*256: h$=fa$: GOSUB 300
    00: fa=dc:fh=INT(fa/256) :fl=fa-fh*
    256: IF e OR e1 OR LEN(sa$)<>4 OR L
    EN(fa$)<>4 OR sa>=fa THEN PUT £sn,1
    1,2: GOTO 63100
63200   ? £sn,"outputting file header":
    OPEN OUT£tp,1,"*1": FOR i=1 TO 11:
    PUT £tp,MID$(t$,i,1): NEXT i: PUT £
    tp,sh,sl,fh,fl: CLOSE £tp:  ? £sn,"
    completed": RETURN
63201   REM
63202   REM sub end
63203   REM


63298   REM output file
63299   REM
63300   ? £sn,"outputting file": OPEN
    OUT£tp,1,"*1": PUT £tp,42: FOR i=sa
    TO fa: PUT £tp,PEEK(i): NEXT i: CL
    OSE £tp:?£sn,"completed": RETURN
63301   REM
63302   REM sub end
63303   REM
```

(continued from page 185)

Monitor file. The Descriptor file contains the file name and start and addresses and the second file the actual machine code. The descriptor files are all the same length because the file name is truncated or padded out to 11 characters. You can change the descriptor file without overwriting the following file.

When using the program, reserve an area of memory for your machine-code routine before entering your code, otherwise Basic may overwrite it. Remove the Rems to reduce the size of the program if you need more space to code in; Mr Parker claims the program will run in a little less than 16K with the Rems removed. You might find it useful to leave out the Error and Break traps until you are satisfied the program is running correctly.

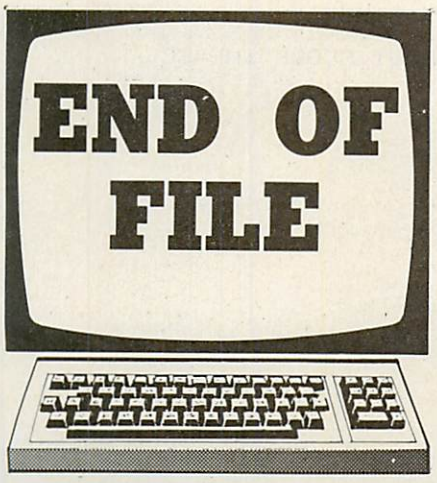
Hangman

For those readers with small children, John Braga of Huntingdon has provided a version of the well-known game Hangman. The words to be used by the program should be typed into lines 1000 to 1099. Line 1099 itself should be left unchanged as the * acts as an End of Data signal. You can choose the words with the age of the child in mind.

Having two small children myself, I know how keen they are to press the buttons. My 3½-year-old daughter was more interested in seeing the little man get drawn than in guessing the word, but either way she had a great deal of fun playing the game.

Hangman.

```
1 REM  HANGMAN PROGRAM FOR NEWBRAIN
2 REM
3 REM (C) JOHN BRAGA 1982
4 REM
5 REM
10 OPEN £0,0,"1200"
20 CLOSE £1 : OPEN £1,11, "160" : REM OP
    EN GRAPHICS STREAM
25 CLOSE £2 : OPEN  £2,5 : REM OPEN KEYB
    OARD FOR SINGLE CHARACTER ENTRY
30 PLOT BCK(1),WIPE,RANGE(24,10): GO=0 :
     WR=0 : REM CLEAR COUNTERS AND SCRE
    EN
40 AL(1)=1 : CLEAR AL() : Y$="" : REM CL
    EAR ARRAY
45 PLOT PLA(7,9),MODE(0), "H A N G M A N
    !"
50 PUT 31 : REM CLEAR TEXT SCREEN
60 READ X$ : IF LEN(X$)>10 THEN 60
65 IF X$="*" THEN CLOSE £1 : CLOSE £2 :
    OPEN £0,0 :PRINT "End of Executions
    !" :  END
70 FOR Z=1 TO LEN(X$)
80 PLOT MODE(1),PLA(Z*1.5+7,5)," " : R
    EM DRAW BLANKS
90 NEXT Z
100 PUT 12: PRINT "Guess a letter! "
110 GET £2,Z : REM GET CHARACTER
120 IF Z<97 OR Z>122 THEN 110 : REM LOOP
     IF NOT ALLOWED
130 PUT Z : REM PRINT IF  OK
140 Z$=CHR$(Z)
145 F=0 : REM FOUND FLAG
150 FOR Y=1 TO LEN(X$)
152 IF MID$(X$,Y,1)=Z$ THEN IF AL(Y)=0 T
    HEN AL(Y)=1 : F=1 : GO=GO+1 : PLOT
    PLA(1.5*Y+7,5→,MODE(2)," "&Z$&" "
154 NEXT Y
156 IF F=0 THEN 300 : REM GOTO 300 IF NO
    T FOUND
160 IF GO<LEN(X$) THEN 100 : REM LOOP BA
    CK IF MORE TO GO
170 PUT 31 : REM CLEAR
180 PRINT "Hurrah!   You have been repri
    eved!"
190 PRINT "Press any key";  : GET £2,Z
200 GOTO 30
300 REM WRONG GUESS!
305 Y$=Y$&Z$ : PUT 22,1,5 : PRINT "Wrong
     - "; Y$
310 WR=WR+1
320 ON WR GOSUB 360,370,380,390,410,420,
    460,480,490,510,560,610,660
325 IF WR=13 THEN 700
330 GOTO 100
350 REM 360-380 DRAW THE SCAFFOLD!
360 PLOT PLA(1,2),DRAW(.5,1,1),DRAW(1.5,
    1,1):RETURN:REM BASE
370 PLOT PLA(1,2),MVE(1,9):RETURN:REM PO
    LE
380 PLOT PLOT PLA(1,9),MVE(3.5,9),PLA(1,
    8),MVE(2,9):RETURN: REM BAR
390 PLOT PLA(3,9),MVE(3,8) :RETURN : REM
     ROPE
400 REM DRAW HEAD
410 PLOT PLA(3,8),DEGREES,TURN(180),ARC(
    PI,360) : RETURN
420 PLOT PLA(3,7.8),FIL : RETURN
450 REM DRAW NECK
460 PLOT PLA(2.9,8),MVE(2.9,6.7),MVE(3.1
    ,6.7),MVE(3.1,8),PLA(3,7),FIL :RETU
    RN
470 REM DRAW BODY
480 PLOT PLA(3,6.7),TURN(180),ARC(2*PI,3
    60):RETURN
490 PLOT PLA(3,6.7),FIL : RETURN
500 REM LEFT ARM
510 PLOT PLA(3,6),MVE(1.6,6),DRW(1.4,6.1
    ,1),DRW(1.4,6,1),DRW(1.4,5.9,1),
            DRW(1.4,5.8,1),DRW(1.4,5.7,
    1)
520 RETURN
550 REM RIGHT ARM
560 PLOT PLA(3,6),MVE(4.3,6),DRW(4.5,6.1
    ),DRW(4.5,6,1),DRW(4.5,5.9,1),
            DRW(4.5,5.7,1)
570 RETURN
600 REM LEFT LEG
610 PLOT PLA(2.5,5,MVE(2,3.4),MVE(2,1.8)
    ,MVE(1.8,2),PLA(2.8,5),
            MVE(2.3,3.4),MVE(2.1,1.8),M
    VE(1.8,2),PLA(2.2,3.4),FIL
640 RETURN
650 REM RIGHT LEG
660 PLOT PLA(3.5,5),MVE(4,3.4),MVE(4,1.8
    ),MVE(4.2,2),PLA(3.2,5),
            MVE(3.8,3.4),MVE(3.9,1.8),M
    VE(4.2,2),PLA(3.9,3.4),FIL
690 RETURN
700 PUT 31
710 PRINT "You are hanged!"
720 PRINT "The word was ";X$
730 PRINT "Press any key ";: GET J2,Z
740 GOTO 30
1000 DATA TEST,EXAMPLE,PUT,ANY,WORD,HERE
    ,
1005 DATA OR,HERE,ETCETERA
1099 DATA * : REM LEAVE THIS AS END-OF-D
    ATA SIGNAL
```



Pinball

A COMPUTERISED VERSION of the arcade game for the Sharp MZ-80k comes from Frank and Lil Rooney of Manchester. The force with which the ball is to be "shot" is selected on a scale 1 to 9 and determines both the initial speed at which the ball travels and also the extent to which it traverses the top of the table before falling.

Points are scored as the ball bounces off the bumpers: five points for the four edge bumpers, 10 for the six round bumpers, and 25 for the two centre bumpers. When hit, the bumper flashes on and off with appropriate sound effects .

The flippers are controlled by the keys B and M but fast responses are required to press the flipper keys just as the ball is on the flipper. There are three balls per game, with an extra ball when a score of 1,000 is reached. The score, high-score and balls left are continuously displayed.

Care must be taken to use the correct graphics sysmbols. Solid symbols are used for all the boundaries. Shaded symbols are used for all the bumpers. The flippers are ASCII character 215.

Poke 10167,1 in line 103 switches off the Peek-protect so that continuous monitoring of the keyboard is possible for the starting key being pressed. The Peek-protect, Poke 10167,0 is restored in line 110 so that subsequent Peeks for location of the ball are limited to video RAM.

Pinball.

```
1 GOSUB111
2 GOSUB71:GOTO61
3 POKEP,0:POKEP+A,71:P=P+A
4 IFFL=1THENFL=0:POKE54109,0:POKE54111,0:POKE54149,54:POKE54151,54
5 GETF$:IFF$=""THENRETURN
6 IFF$="B"THENFL=1:POKE54149,0:POKE54109,118:MUSIC"GO":RETURN
7 IFF$="M"THENFL=1:POKE54151,0:POKE54111,119:MUSIC"GO"
8 RETURN
9 PRINT"■■■■■■■■■";SC:RETURN
10 PQ=0:IFP<G(1)THEN13
11 FORF=1TO6:IFP=G(F)THEN53
12 NEXTF
13 IFPEEK(P+A)<>0THEN25
14 IFP=53404THENA=-41
15 GOSUB3:GOTO10
16 FORD=1TO8:IFO(D)=ATHEN18
17 NEXTD
18 D=D+INT(RND(1)*5+2):IFD>8THEND=D-8
19 IFD<1THEND=D+8
20 A=O(D):PL=P:GOTO10
21 IFP=54110THEN53
22 IF(P=54109)*(F$="B")THENA=-41:GOSUB3:GOTO10
23 IF(P=54111)*(F$="M")THENA=-39:GOSUB3:GOTO10
24 A=FF:FORII=1TO30:NEXTII:GOSUB3:GOTO21
25 FORJ=1TO8:IFPEEK(P+A+O(J))=74THENM=P+A+O(J):GOTO42
26 NEXTJ
27 PP=PEEK(P+A):IFP<G(2)THEN31
28 IF(PP=67)*(P<54110)THENFF=1:GOTO21
29 IF(PP=54)*(P<54110)THENFF=1:GOTO21
30 IF(PP=67)+(PP=54)THENFF=-1:GOTO21
31 FORJ=-1TO1:IFPEEK(P+A+J)=212THENM=P+A+J:P1=212:GOTO46
32 NEXTJ
33 FORJ=-40TO40STEP40:P2=PEEK(P+A+J)
34 IF(P2=209)+(P2=210)THENM=P+A+J:P1=P2:GOTO46
35 NEXTJ
36 IF(PP=67)+(PP=66)+(PP=77)+(PP=78)+(PP=86)THENPQ=2
37 IF(PQ=2)*(P<>PL)THENMUSIC"_DO"
38 IFPQ=2THEN16
39 FORJ=1TO10:IFPEEK(P+A+F(J))=75THEN47
40 NEXTJ
41 GOTO16
42 FORL=1TO3
43 FORK=2TO8STEP2:POKEM+M(K),0:NEXTK:MUSIC"¯AO"
44 FORK=2TO8STEP2:POKEM+M(K),208:NEXTK:MUSIC"AO":NEXTL:SC=SC+10
45 GOSUB9:GOTO16
46 FORI=1TO2:POKEM,0:MUSIC"AO":POKEM,P1:MUSIC"_AO":NEXTI:SC=SC+5:GOSUB9:GOTO16
47 Q=P+A+F(J):FORL=1TO5
48 POKEQ-40,0:POKEQ-39,0:POKEQ-1,0:POKEQ+2,0:POKEQ+39,0:POKEQ+42,0
49 POKEQ+80,0:POKEQ+81,0:MUSIC"¯DO"
50 POKEQ-40,215:POKEQ+42,215:POKEQ-39,216:POKEQ+39,216
51 POKEQ+2,213:POKEQ+80,213:POKEQ-1,214:POKEQ+81,214
52 MUSIC"¯AO":NEXTL:SC=SC+25:GOSUB9:GOTO16
53 IF(P=54017)+(P=54043)THENA=40:GOSUB3
54 IF(P=54057)+(P=54083)THENA=40:FORH=1TO2:GOSUB3:NEXTH
55 IFPEEK(P+A)=77THENA=41:GOSUB3:A=1:GOSUB3:GOTO59
56 IFPEEK(P+A)=78THENA=39:GOSUB3:A=-1:GOSUB3:GOTO59
57 A=40:GOSUB3
58 IFPEEK(P+A)=0THENGOSUB3
59 MUSIC"_A7":POKEP,0:P=PS:GOSUB103
60 IF(WW=0)*(SC>=1000)THENBA=BA+1:WW=1
61 IFP<53485THEN63
62 FORI=1TO(11-Z)*10:NEXTI:A=-40:GOSUB3:GOTO61
63 A=-41:GOSUB3
64 FORX1=1TOZ1:FORI=1TO(11-Z)*5:NEXTI:A=-1:GOSUB3:NEXTX1
65 A=40:GOTO10
66 PRINT"■GAME OVER■■■"
```

(continued on next page)

(continued from previous page)

```
 67 PRINT"SCORE =";SC:IFSC>HSTHENPRINT"■THIS IS THE HIGHEST SCORE":HS=SC
 68 PRINT"■■Press any key for another game"
 69 GETA$:IFA$=""THEN69
 70 GOTO2
 71 PS=54165:BA=3:SC=0:WW=0:PRINT"■";
 72 PRINTT$;"◢▓▓▓
```

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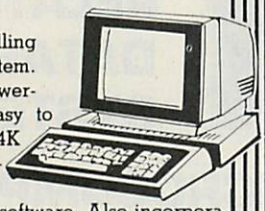

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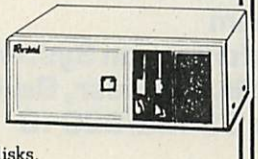

MINSTREL
The U.K.'s competitively priced, S-100 bus based microcomputer with integral high capacity hard disks. Manufactured in England, the MINSTREL standard configurations include 800K — 1.6mb floppy and 5-20 mb of hard disk storage.

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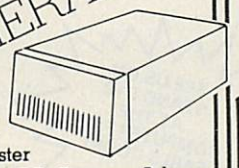
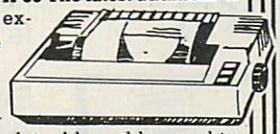
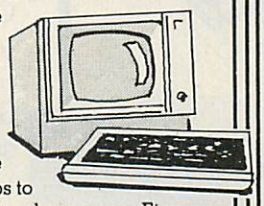


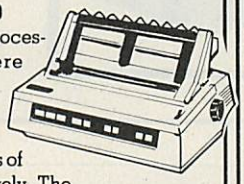
INTERAM HARD DISK
Now there is a Winchester disk system for your IBM PC, Sirius or Advantage computer which offers high performance and unrivalled reliability at a realistic price. Disk systems range from 5 to 40 MB with fixed and/or removable cartridge disks.



EPSON RX-80 and FX-80 The latest additions to Epson's range of extremely reliable printers, with speeds of 100 and 160 cps respectively. Both feature dot addressable graphics with centronics parallel interface as standard with optional RS-232C and IEEE interfaces.

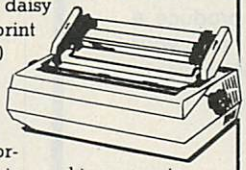


ICL KDS7362 This is ICL's latest VDU designed for the microcomputer market. The KDS 7362 is good and attractively designed. Supplied with every VDU are an extra set of keycaps to support several foreign languages. Firmware compatible with Televideo TVI-950.

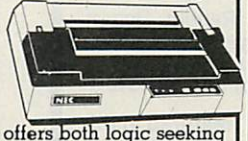


NEC 2000R and 3500
Designed for word processing systems, where speed is not essential, but quality is, these high performance spinwriters have speeds of 20 and 35 cps respectively. The advanced design of these models eliminates the problems of adjustments or lubrication

INSIGHT VDT-6 & VDT-8
Very competitively priced Wordstar VDUs. 12" and 15" screens respectively. Both models incorporate a Wordstar customized key board. Firmware compatible with Televideo TV-912.



FLOWRITER RP1300 and RP1600 High performance, reliable, daisy wheel printers with print speeds of 37 and 60 cps respectively. The Flowriter's internal microprocessor controls proportional spacing, logic seeking, margin justification and internal 8K RAM buffering.



NEC 8023A
Fast reliable printing on a 7x9 dot matrix, at 100 cps and up to 136 characters/line. Also offers both logic seeking and incremental-mode bi-directional printing.

PRISM 80 and 132 quality dot-matrix printer. Special features are colour printing, correspondence mode and single sheet feed capability.

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dBASE II: One of the world's foremost programmable data base management packages. Ashton Tate's dBase II has comprehensive file handling, screen handling and report printing facilities. Interfacing to files created by other languages such as BASIC or WordStar is supported.

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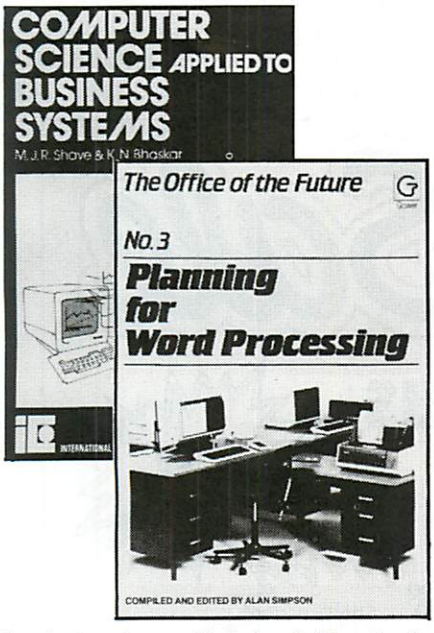
Business books

Business users need help not hindrance; John Cookson found it hard to come by.

MANY AUTHORS have attempted to provide the business users with the information they need to apply microcomputers successfully, generally with very limited success. *Choosing and Using a Business Microcomputer* by Robin Bradbeer, Barry Miles, Julian Allason and Robert Webb is no exception.

The whole area is treated in less than 200 pages, so the text is necessarily superficial. Some useful general advice is given, but in practice the business user is presented with problems for which detailed knowledge is required — estimating the size of an application, for example. Such information is not provided by this text, and there are some amazingly sloppy or incorrect statements. One particularly glaring one is a reference on page 61 to "another language called Pascal, a more efficient version of Basic".

The acid test for a book on this subject


COMPUTER SCIENCE APPLIED TO BUSINESS SYSTEMS
M.J.R. Shave & K.N. Bhaskar
The Office of the Future
No. 3
Planning for Word Processing
COMPILED AND EDITED BY ALAN SIMPSON

is whether it would help sigificantly in making sure business users are able to find a system to fulfil their needs. This one would not.

Personal Computing by Daniel E McGlynn is an ambitious attempt to cover the entire spectrum of personal computing from satellite communications and databanks to interfacing techniques. Its last 112 pages are filled with appendices, mostly containing information which is of doubtful value and liable to become outdated rather quickly.

There are a number of useful tables and diagrams, but in attempting to cover such a wide area the author can only give sketchiest overviews of the material. Some of the text is outdated — the section on APL on micros, for example — and there are mistakes, as in the Pascal program on page 92 which has a syntax error. Most of the book is fairly up to date, and it includes information on the IBM PC. It could be seen almost as an illustrated dictionary of terms used in personal-computing applications.

Osborne and Cook's *Business System Buyer's Guide* starts with an excellent idea. It presents a set of case studies illustrating boondoggles which occur when computers are introduced to businesses without proper planning and design.

One of the unfortunate assumptions the authors make is that a computer is a good idea. Most businesses would be better off if the first question they asked themselves was "do we need a computer?" rather than worrying about how to introduce one.

As an antidote to the difficulties they illustrate, the authors stress the importance of system specification. Unfortunately, this is where their promising approach starts to fall down as their introduction to the specification process it too short and sketchy.

In other areas, the general advice given is in some cases dangerous. For example, they say that the language chosen makes no difference to the user which, if the difference is between a compiled language and a much slower interpreted one, may be far from the case.

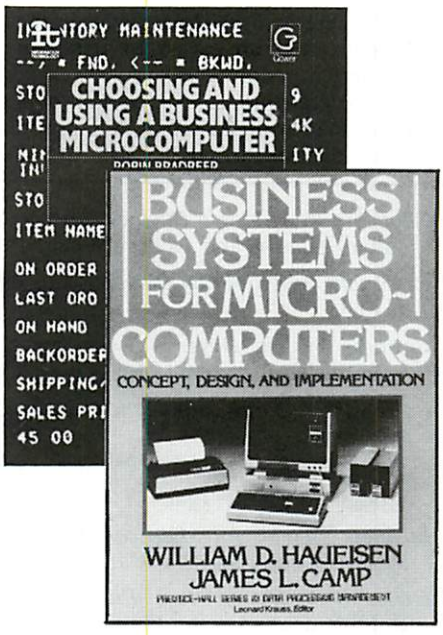
Osborne and Cook do give some good advice, but not enough to allow business users to approach the introduction of computers with confidence.

Reading Richard W Lott's *Basic with Business Applications* is like travelling back in time. It is one of the worst texts on programming I have ever seen.

The first 12 chapters provide a disastrous introduction to Basic and are an excellent receipe for producing badly structured "plate of spaghetti" programs. The examples in the text are extremely poor, and the author does not apparently believe in commenting on his programs.

Many books on Cobol are extremely turgid and hard to read. It is therefore a pleasure to find *Computer Programming in Cobol* by Melinda Fisher, which is short, easy to read and clearly written by an author who is well aware of the pitfalls and problems of presenting the language. A conventional introduction to the syntax is interspersed with a number of helpful suggestions to students.

The only weakness is that Fisher does not discuss program design in sufficient


CHOOSING AND USING A BUSINESS MICROCOMPUTER
BUSINESS SYSTEMS FOR MICRO-COMPUTERS
CONCEPT, DESIGN, AND IMPLEMENTATION
WILLIAM D. HAUEISEN
JAMES L. CAMP

depth, this would be impossible in a book of this length. All in all it makes an excellent supplementary text, though it would need to be added to in order to give a balanced introduction to programming.

The 416-page *Business Systems for Microcomputers, Concept, Design and Implementation* by W D Haueisen and J L Camp should certainly be big enough to provide an adequate introduction to the topic described by its title. It is, however, a big disappointment. Although it talks about microcomputer selection, it rapidly chooses one particular manufacturer, Datapoint, to model the systems it discusses. It therefore offers the reader little help with the critical analysis phase, when the nature and size of the application is assessed and the basis for selecting the hardware is determined.

Equally, the book gives little help when it comes to the selection of packages. Analysis of the potential applications is dealt with in a very cursory fashion. The authors decide on what is clained to be a database approach to systems implementation but do not use a proprietary DBMS system or any of the analytical tools associated with database implementations. Nowhere are the problems of taking this route discussed adequately, especially the problem of maintaining integrity of the database in the event of serious failure. The text inevitably launches into great detail on the problems of file design.

The text finishes with a sketchy desription of integration and use, and includes a brief and rather poor

(continued on next page)

(continued from previous page)
discussion of distributed data processing. The authors think testing programs is a good idea, but fail to give any rational strategy for doing so.

The most serious worry about a book like this is that someone might read it and try to implement a system based on what it says. That would be a recipe for disaster: there is insufficient detail in the right areas, and an excess of detail in areas where it is not necessary.

Office of the Future No. 3, Planning for Word Processing edited by A Simpson is a compilation of the views of 18 individuals and groups active within the general areas of word and text processing. The contributions are mostly clear and well-written and well-suited to their intended audience: managers who are contemplating the introduction of word-processing systems.

Accepting that each contributor has to say how wonderful his own firm's efforts are in this field, there is still a wealth of information and food for thought in the text. It is in the general advice it gives that this book is most useful. The basic terminology is clearly explained and the the pitfalls are well delineated.

The most useful contributions are those on system selection and feasibility by Richard Grimes, which contains a lot of solid common sense, and the Phillips Checklist to Word Processing which again has much useful and helpful information. At £9.50 it is an expensive book, but a worthwhile investment for managers at whom it is aimed.

Computer Science Applied to Business Systems by M J R Shave and K N Bhaskar is aimed at the computer-science student who needs an introduction to the application of computers to business problems. There has long been an unfulfilled need for such a text and this book satisfies it admirably.

In 240 pages the work cannot be exhaustive, but it covers all the major areas adequately. It starts from defining systems analysis, then describes the basic features of computer systems, how business is organised, accounting systems, file organisation and processing, data capture, description and documentation of systems, ordered access to data, and on-line and real-time systems.

The text is commendably clear and concise, and manages to pack a vast amount of information into comparatively few pages. Obviously the book would have to be supplemented by other texts, but it provides an excellent foundation for the student or hobbyist, or even professional programmers who wish to broaden their knowledge.

Choosing and Using a Business Microcomputer by Robin Bradbeer, Barry Miles, Julian Allason and Robert Webb. Published by Gower, 171 pages, £12.50.

Personal Computing by Daniel R McGlynn. Published by John Wiley, 335 pages, £11.65.

Business System Buyer's Guide by A Osborne and S Cook. Published by Osborne/McGraw-Hill, 165 pages, £5.95.

Basic with Business Applications by Richard W Lott. Published by John Wiley, 306 pages.

Computer Programming in Cobol by Melinda Fisher. Published by Hodder and Stoughton in the Teach Yourself series, 202 pages, £2.95.

Business Systems for Microcomputers, Concept, Design and Implementation by W D Haueisen and J L Camp. Published by Prentice Hall, 416, pages, £19.95.

Office of the Future No 3, Planning for Word Processing edited by A Simpson. Published by Gower, 150 pages, £9.50.

Computer Science Applied to Business Systems by M J R Shave and K N Bhaskar. Published by Addison-Wesley, 246 pages, £6.95.

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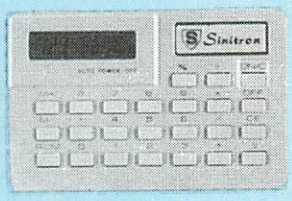

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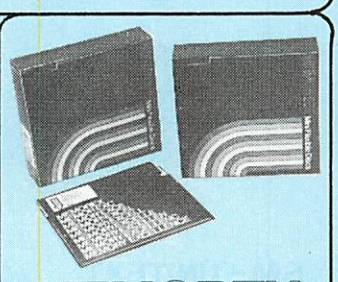

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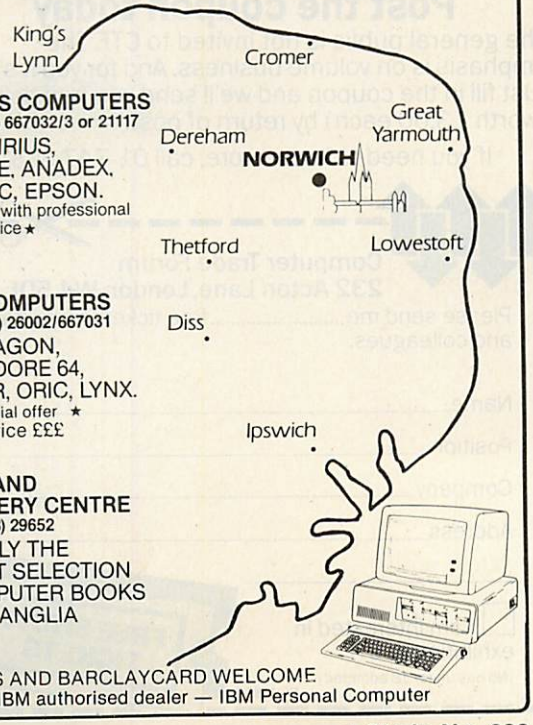

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>PRINTERS AND PLOTTERS

The special section in the August issue is devoted to those essential devices, printers and plotters. We look at how to go about buying a printer, and report on some recent models including the Epson FX-80 and the Olivetti spark ink-jet printer, the JP-101. Other features deal with plotters, buffers and — most difficult of all — connecting everything up.

>FROM BBC BUGGY TO IBM XT

The range of hardware to be reviewed stretches all the way from the BBC Buggy to the new hard-disc version of the IBM PC running under MS-DOS version 2. Chris Bidmead tells the truth about the Corvus Concept, and Neville Maude unveils the Wordwise plug-in word processor for the BBC Micro.

>AND MUCH MORE!

How do you illustrate three-dimensional data? Dave Watson explains stereoscopic slicing, and provides a listing in Basic. Other features cover the problems of protecting software by copyright and the use of floating-point numbers. Plus part 2 of Formcalc, the usual enjoyable fiction — computer dating this time — pages and pages of free software in Open File, columns, new product news, Boris Allan and your letters.

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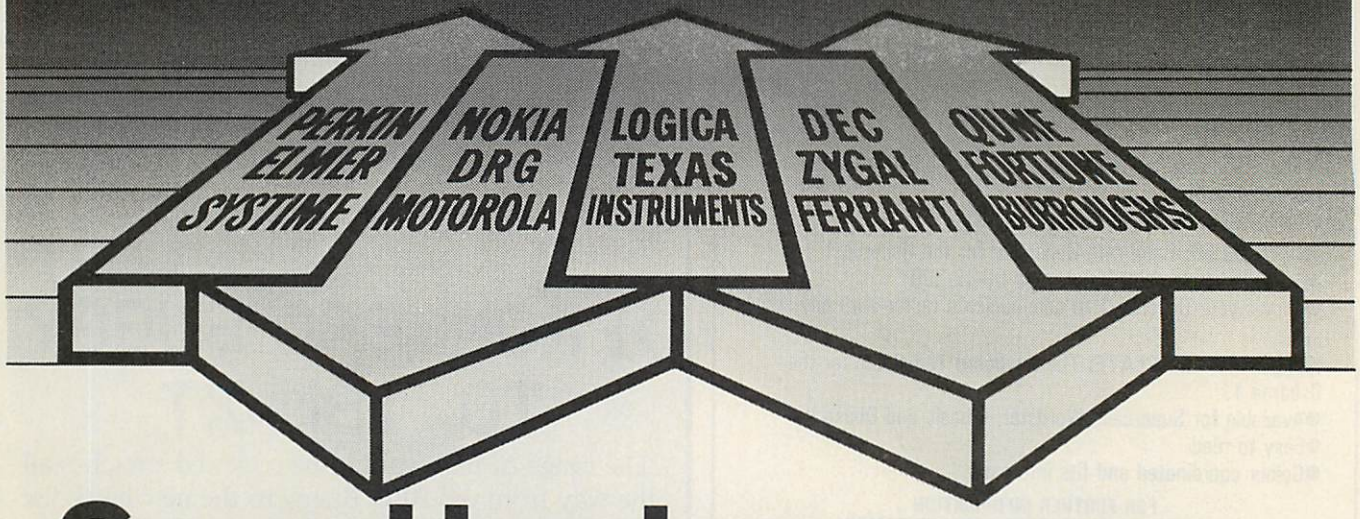

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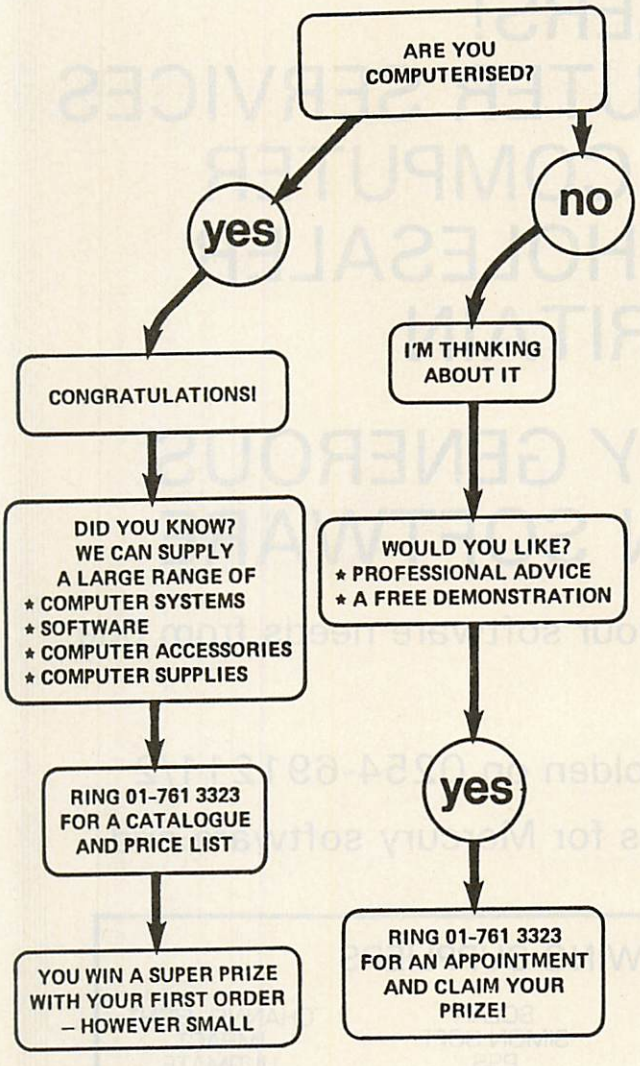
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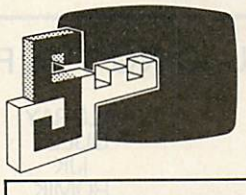

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Protected species

Chris Naylor has some thoughts for the new government when it comes to draft its legislation for data protection.

THE DATA PROTECTION BILL was the first-ever attempt in British history to legislate the previously legitimate activities of the computer user. As such it has attracted extensive comment in the quality media of the non-magnetic variety.

So for the average computerperson in the street, what were the principles of the Data Protection Bill, and exactly why does data need protecting anyway? To answer these questions we must turn to history.

The history of data goes back almost — but not quite — as far as history itself. For when we say Data we are, in a very real sense, saying Numbers and they were first invented around 530 BC by the ancient Greek, Pythagoras. This may come as something of a surprise — that numbers had a need to be invented is by no means apparent.

Prior to the time of the ancient Greeks there were no numbers, only things which were numbered. The difference is an important one for on it rests the whole body of modern computer science.

Take, for example, the problem of 4/2 = 2. Now to pre-Pythagoreans this statement was meaningless. "4" cannot exist by itself, they would have argued, and nor can "2". Given, for instance, four sheep it is possible to have half of those sheep — that is two sheep — but it is impossible to have numbers existing in isolation. Four sheep divided two ways makes sense but 4 divided by 2 does not.

Once invented, the value of numbers was immense and with the possession of them came power. So much so that the prime questions which then arose were: how many numbers are there, and where are the numbers to be kept?

Pythagoras answered these questions very cleverly by saying that the numbers were to be kept on the real line. He said that the numbers were everywhere dense on the real line — that is, that there were lots of them.

Naturally, the results of this announcement were far-reaching. At that time, Greece was the only state which had knowledge of the real line and its whereabouts. Greece had an immediate and total monopoly on the supply of data to the rest of the known world and its position seemed secure.

Time, the great eroder, proved such thinking false. As the population of the world grew and the people became increasingly numerate the real line did at last begin to show signs of depletion. Numbers were being read and used indiscriminately and were not always replaced correctly. Eventually, soon after the Dark Ages, the world grew up to the realisation that it had a crisis on its hands when decent, numerate people found that 2 and 2 scarcely made 4 anymore.

It was at this time that a European came dramatically to the rescue. His name was Argand and, at a stroke, he gave the world a great new supply of numbers. He did so simply by stating that as well as the real line, there was also an imaginary line at right angles to the first and that numbers on this newly discovered line were just as dense as they had been on the real line in the good old days of Pythagoras.

To prove what he was saying, Argand drew his famous diagram and claimed that both real and imaginary parts existed in the new, all-encompassing complex plane. The effect of the new numbers was immediate and dramatic.

Stock markets flourished and fortunes were made overnight as people experienced a glut of numeracy. One of the new companies which was established at that time was the South Sea Bubble Company which attracted investors' money on the grounds of having sighted the Argand diagram with attached complex plane, viewed from the top, as far south as the Azores.

For a great while peace and prosperity reigned supreme again with only minor problems caused by an erroneous identification of the Argand diagram with the Earth's meridian and equator. For instance, it was found that a naval shell fired from north-west to south-east would return to hit the ship which fired it unless the argument of its trajectory were adjusted in mid-flight.

But this was a minor problem to a world in which data could now flow freely. And yet the dark days of 1940 brought yet darker days as the impact of the first computing engines began to be made clear. Originally designed for code-breaking the first engines to consume data appeared to be nothing but a blessing — until, that is, the first small cracks began to appear in the complex plane.

Working in almost total darkness government scientists were able to discern that the new computing engines were indeed depleting the complex plane faster than it could regenerate itself, and the plane was indeed shrinking. But that was wartime and their report was suppressed for fear of causing panic and giving comfort to the enemy. And so the matter was forgotten — but unwisely so.

It had been hoped that with peace would come the end of the use of computing engines of any significant power. But the powers that be had reckoned without the inexorable quest for more and yet more data. With the advent of the silicon chip, the position became all too clear.

Suddenly, numbers everywhere were being consumed at megabit rates by engines which never broke down. The complex plane began to shrink and crack at an alarming rate as data was ripped mercilessly from its very being. Emergency attempts failed to build a new line, at right-angles to both the real and imaginary lines. The computation of its position would have used more data than there was, even then, left in the world.

And then, just as a general breakdown of law and order seemed most imminent, the British government acted. The solution was the Data Protection Bill.

The prime aim of the Bill was to protect data so that it may grow and create new data items. It is not suggested that there is anything wrong in reading data as such — indeed, what could be more natural? It is merely the wanton despoliation of data which is to be restrained.

Briefly then, the main provisions of the Data Protection Bill were that data shall not be read, or output, or offered for sale while it is subject to any or all of the following conditions:

While that data item is being used to write new data.

While that data is below a certain size, typically 10 characters.

At a time of year such that a reasonable person might presume the data is likely to be in one of the previously mentioned states, for example at the end of a financial year.

While that data exists on February 29.

Notwithstanding any or all of the above, the Close Time on data shall be January 1 to December 31 excluding Christmas Day, and December 26 to December 24 inclusive of Christmas Day. Further, the use of data-consuming engines in an attempt to calculate Open Times on data from the above is prohibited.

The Data Protection Bill died peacefully on May 13, 1983. Shall we ever see its like again?

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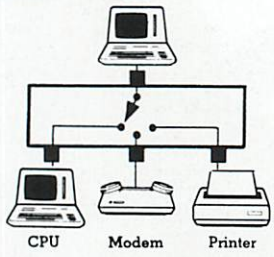

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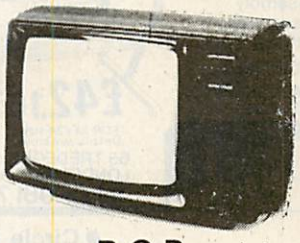

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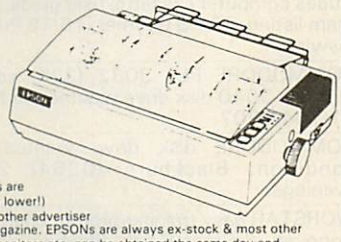

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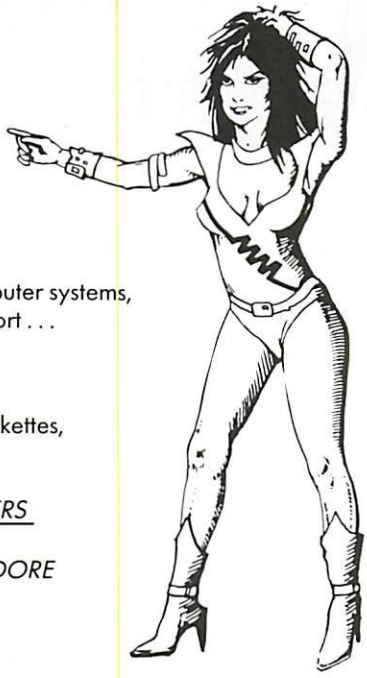

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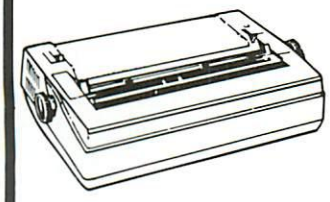

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